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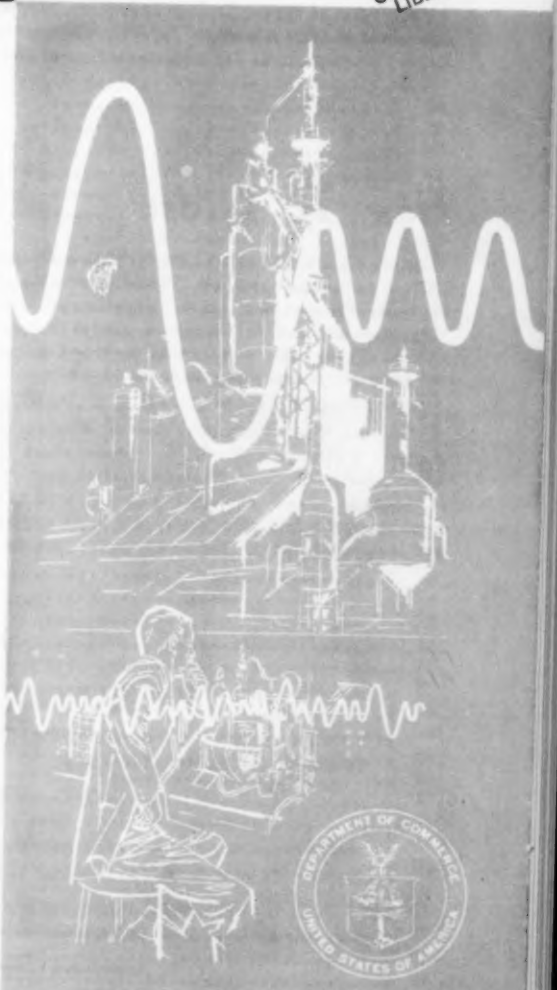

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Armed Services Technical Information Agency, Arlington, Va.
PROTECTIVE CONSTRUCTION: A REPORT BIBLIOGRAPHY. Nov 60, 85p. 405 refs. AD-242 653.
Order from OTS $2.25 PB 171 106

This report released for sale to the public 17 Nov 60.

This bibliography comprises a selected list of references related to construction of "hardening" of strategic military facilities to resist either nuclear or conventional explosives. References are limited to unclassified reports without specific distribution limitations. Literature coverage is restricted to documents within the Armed Services Technical Information Agency's collection, cataloged from 1952 to September 15, 1960. Entries include references to reports pertaining to characteristics of nuclear explosions, propagation of shock waves, underground explosions, soil mechanics, and response to structures to blast.

AGRICULTURE

Plant Cultivation

Laboratory of Climatology, Centerton, N. J.
THE CLIMATIC AND HYDROLOGIC FACTORS AFFECTING THE REDISTRIBUTION OF SR^{90}, by J. R. Mather and J. K. Nakamura. Final rept. (Technical rept. no. 1) on Contract AF 49(638)409. June 60, 22p. AFOSR-TR-60-101; AD-241 890.
Order from LC mi$2.70, ph$4.80 PB 150 614

The influence of climatic and hydrologic factors on the redistribution of strontium in the upper layers of the soil has been studied. Starting with the results of a laboratory study of the movement of strontium-89 under the action of different volumes of several leaching agents, it was possible to work out a mathematical model of movement which corresponded very closely with the laboratory results. The model resulted in the uniform downward leaching of a given percentage of the strontium in each layer in the soil for each unit of leaching solution applied. The actual leaching efficiencies of CaCl, NaCl, and deionized water were determined from the available experimental results. Testing of the mathematical model of movement by computing the actual distribution of strontium with depth in the soil at five different sites verified the usefulness of the model and showed a definite climatic influence on the leaching efficiency. (See also PB 150 615 - PB 150 617).

[Laboratory of Climatology, Centerton, N. J.]
EQUATION AND TABLE FOR DETERMINATION OF THE WAVE OF LEACHING IN THE SOIL, by C. W. Thornthwaite and Sally Thornthwaite. Appendix no. 2 to Final rept., Technical note no. 3 on Contract AF 49(638)409. [1960] 28p. AFOSR-TN-60-875; AD-241 892.
Order from LC mi$2.70, ph$4.80 PB 150 616

A consideration of distributions obtained in various leaching experiments suggest that there is an organized movement of the leachate downward in the soil in response to the application of a leaching solution such that a certain percentage of the original concentration moves downward to the next lower layers in the soil with each unit of water applied. The equation developed to describe the wave of leaching in the soil is identical to the equation of the binomial distribution. (See also PB 150 614, PB 150 615)

Laboratory of Climatology, Centerton, N. J.
THE ROLE OF THE WATER BALANCE IN THE REDISTRIBUTION OF STRONTIUM IN THE SOIL, by John R. Mather. Appendix no. 1 to Final rept., Technical note no. 1 on Contract AF 49(638)409. [1958] 13p. 8 refs. AFOSR-TN-60-97; AD-241 891.
Order from LC mi$2.40, ph$3.30 PB 150 615

Knowledge of the water balance is basic to any understanding of the distribution of strontium both geographically and with depth in the soil. The studies of the chemistry of the soil and of rain water have been undertaken to provide information on the leaching efficiency of different solutions, whether rain water or soil solutions. Knowledge of leaching efficiency is of little value

unless there is also precise information on the cation exchange capacity of soils both with depth and in areal extent. The two factors of leaching efficiency of the solution and exchange capacity of the soil must go hand in hand in any determination of the rate of movement of strontium in the soil. The work undertaken so far merely represents a first step in a long range study designed to provide a clearer understanding of the nature and characteristics of strontium-90 and its relation with the moisture factor in climate. (See also PB 150 614).

ASTRONOMY

Astrophysics

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE ANGULAR POWER SPECTRUM OF LUNAR RADIO ECHOES, by Fred B. Daniels. 25 May 60, 11p 7 refs. USASRDL Technical rept. 2129; AD-239 464.
Order from LC mi$2.40, ph$3.30 PB 150 451

The theory of radar reflections from the moon developed in an earlier report is extended to the determination of the angular power spectrum, and comparisons are made with experimental results. Satisfactory agreement is found except for weak Lambert-law scattering that occurs near the limb. The possibility is suggested of using simultaneous pulse and fading measurements to determine the rate of rotation of a planet. Results of both pulse and fading tests are interpreted as due to scattering from the small-scale surface features of the moon. (Author). (See also PB 146 937).

Carter Observatory (New Zealand).
HEIGHTS AND LOCATIONS OF THE AURORA AUSTRALIS FROM DUPLICATE AND SINGLE PHOTOGRAPHS, 1938-1941 [AND] ANNUAL, DIURNAL AND GEOMAGNETIC LATITUDE VARIATIONS OF THE AURORA AUSTRALIS, by G. W. McQuistan and B. L. Frankpitt. Scientific rept. nos. 7 and 8 on Contract AF 64(500)4. [1959] 78p. 10 refs. GRD TN-60-628.
Order from LC mi$4.50, ph$12.30 PB 150 942

The present report contains the results of the measurement of parallactic and single station photographs of the Aurora Australis, exposed between the years 1938 and 1941 inclusive. This completes the analysis of all plates up to 1951 held at the Carter Observatory. An amended method of calculating the base line constants is given and has been used to compute the constants for this report. (See also PB 138 236)

Carter Observatory (New Zealand).
OBSERVATIONS OF THE AURORA AUSTRALIS, 1957 AND 1958, by G. W. McQuistan. Scientific rept. no. 9 on Contract AF 64(500)4.]1959] 81p. AFCRC TN-60-414.
Order from LC mi$4.80, ph$13.80 PB 150 941

Visual observations of the Aurora Australis collected in New Zealand, New Zealand Antarctic stations and adjoining regions over the period 1957 and 1958 are here recorded in a form suitable for further researches. The arrangement of the report has been designed in semi-analytical form which it is hoped will render it more suitable for future work. (Author) (See also PB 150 942)

Center for Radiophysics and Space Research, Cornell U., Ithaca, N. Y.
FARADAY DISPERSION IN THE SOLAR ATMOSPHERE, by Kenji Akabane. Radio Astronomy Technical rept. no. 4 on Contract Nonr-401(27). 30 Jan 60, 34p. 12 refs. Research rept. RS2; AD-239 772.
Order from LC mi$3.00, ph$6.30 PB 149 007

The degree of linear polarization in solar bursts was measured simultaneously at two bandwidths, 10 kc and 22 kc, each having the same center frequency, 201.6 mc. A number of partially linearly polarized type III bursts were seen, and in every case the burst was more polarized in the narrow band than in the wide band. According to the theory of Faraday dispersion, the ratio between the degree of polarization observed at each two bandwidths gives the degree of polarization at the source ρ_o, the Faraday rotation angle ϕ, and the dispersion angle θ.

Geophysical Inst., U. of Alaska, College.
SOLAR RADIATION AND RADIANT HEAT EXCHANGES IN ARCTIC REGIONS, by Carol Echols. July 60, 25p. 4 refs. AAL Technical rept. 58-27.
Order from LC mi$2.70, ph$4.80 PB 150 573

Studies of the microclimate were conducted in an area north of College, Alaska, at Ballaine's Lake Field Station. The work was limited to studies of the radiation environment, with particular emphasis on winter conditions. Measurements were made of snow and air temperatures, and also of total incoming radiation and the net radiation exchange.

Harvard Coll. Observatory, Cambridge, Mass.
PHOTOMETRIC OBSERVATIONS OF MARS IN 1941 AND 1958, by Gerard de Vaucouleurs. Scientific rept. no. 5 on Contract AF 19(604)3074. 15 Aug 60, 36p. GRD TN-60-616.
Order from LC mi$3.00, ph$6.30 PB 150 741

Mean relative brightness values are given for 113 regions of the surface of the planet Mars in white, green and red light, from 2551 eye estimates obtained in 1941 and 1079 in 1958. (Author)

Iowa State U., Iowa City.
BALLOON OBSERVATIONS OF X-RAYS IN THE AURORAL ZONE I, by Kinsey A. Anderson. [1959] 36p. 12 refs. Rept. SUI-59-22.
Order from LC mi$3.00, ph$6.30 PB 150 517

From several high altitude balloon flights made in the Northern Auroral Zone observations have been on fre-

quently appearing fluxes of x-rays. By use of sodium iodide scintillation crystals and pulse height analyzers also carried in the balloon instrumentation detailed measurements of the photon energy spectrum in the re gion 40 to 340 kev have been obtained. These x-rays generally appear without definite geophysical or solar correlation. They are believed to be directly related to the soft radiation investigated by rockoons and also to processes occurring in the outer Van Allen radiation zone. The rapid intensity and spectral fluctuations that are observed suggest that in addition some process, possibly atmospheric discharge, may also be important. The relation of these x-rays to visible aurorae is not clearly established here. (Author).

Iowa State U., Iowa City.
PRIMARY COSMIC RAY INTENSITY NEAR SOLAR MAXIMUM, by Frank B. McDonald. Rept. on [Contract N9onr-938(03)]. [1959] 11p. 6 refs. SUI-59-11.
Order from LC mi$2.40, ph$3.30 PB 152 057

The direct measurement of primary cosmic ray proton and alpha particle fluxes and energy spectra has been previously reported for a period of relatively low solar activity (1955-1956). These cosmic ray measurements have now been extended to the recent period of high solar activity. Strong constraints on the nature of the long term modulating mechanism are provided by the simultaneous determination of the spectra of two components with different charge to mass ratio.

Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.
THEORETICAL STUDIES OF INTENSITY, LINE-WIDTH AND LINE SHAPE IN RESOLVED INFRARED SPECTRA, by William S. Benedict. Final rept. for 1 Sep 55-31 Aug 58 on Contract AF 18(600)1557. [1958] 118p. 149 refs. [AFOSR] TR-59-61; AD-216 657.
Order from LC mi$6.00, ph$18.30 PB 152 054

The researches have made a number of detailed advances in the understanding of the spectra of NH_3 and H_2O.
Included in the report are:
Interaction of stretching vibrations and inversion in ammonia, pub. in The Jnl. of Chemical Physics 24:904, Apr 56
Structure of perchlorylfluoride from high-resolution infrared spectra, pub. in The Jnl. of Chemical Physics 25:594-595, Sep 56
Identification of H_2O^{18} and H_2O^{17} telluric lines in the infrared solar spectrum, pub. in Mémoires de la Societe Royale des Sciences de Liège 18:557-571, 1957
Comments on the spectra of telluric H_2O and CO_2 as observed in the solar spectrum 2.8 - 23.7 microns Special volume 2:18-30, 1957
Vibration-rotation bands of ammonia:
I. The combination bands $\nu_2+(\nu_1, \nu_3)$, pub. in Jnl. of Research of the National Bureau of Standards 61:123-147, Sep 58
II. The molecular dimensions and harmonic frequencies of ammonia and deuterated ammonia, pub. in Canadian Jnl. of Physics 35:1235-1241, 1957
III. The region 3.2-4.3 microns, pub. in The Jnl. of Chemical Physics 29:829-845, Oct 58
Calculation of line widths in H_2O-N_2 collisions, pub. in The Jnl. of Chemical Physics 30:388-399, Feb 59.

Liège U. (Belgium).
EXCITATION AND ABUNDANCES IN COMETS, by P. Swing. Technical note no. 5 on Research on Relations between Cometary and Upper Atmospheric Physics, Contract AF 61(052)24. 6 Apr 60, 15p. 16 refs. AFCRC-TN-60-439.
Order from LC mi$2.40, ph$3.30 PB 150 943

Intensity anomalies observed in the rotational lines of Swan bands of comets are due to the presence of absorption lines in the exciting solar radiation. It is thus proved that the Swan bands are excited by fluorescence, although their lower level $^3\pi_u$ is not the ground electronic state of C_2. The nuclei of the periodic comets 1957c and 1959b have radii of the order of one kilometer. The relative abundances of CO^+ (in the tail) and CN (in the head) in Comet Bester 1947k have been determined. At nucleocentric distances less than 130,000 Km the CO^+ ions are ten times as abundant as CN; at the edge of the head (150,000 Km) N(CO^+) $\sim$20 N(CN). The abundances of CO^+ are much greater than usually considered. (Author)

Liége U. (Belgium).
HELIOGRAPHIC POSITIONS OF TEN COMETS. Technical scientific note no. 3 on Contract AF 61(052)24. Jan 60, 42p. AFCRC TN-60-296.
Order from LC mi$3.30, ph$7.80 PB 150 938

Considering the interest shown recently in the effect of "solar wind" on comets it has seemed useful to us to prepare tables of heliographic coordinates for a number of recent comets, also for Periodic Comet Encke 1960 which will be observable in 1960 and 1961. Comparison of cometary- solar- and geophysical phenoma will thus be easier. (Author).

Liége U. (Belgium).
RELATIONS BETWEEN COMETARY AND SOLAR ACTIVITY. Technical scientific note no. 4 on Contract AF 61(052)24. Mar 60, 11p. 37 refs. AFCRC TN-60-401.
Order from LC mi$2.40, ph$3.30 PB 150 940

This note is concerned with a comparison of the behavior of dust- and gaseous cometary heads in relation to solar activity. The available material seems to indicate that the brightness of a dust-head is not related appreciably to solar activity, while a gaseous head may be. It is suggested that Comet Encke be carefully observed photometrically at its next return, late in 1960 and early in 1961. (Author).

Liege U. (Belgium).
RELATIVE INTENSITIES OF FORBIDDEN OI LINES IN AN EXPANDING STELLAR ATMOSPHERE. Technical scientific note no. 2 on Contract AF 61(052)24. Jan 60, 25p. 8 refs. AFCRC TN-60-297.
Order from LC mi$2.70, ph$4.80 PB 150 939

The relative intensities of the red and green [OI] lines have been computed for eight types of diluted atmospheres expanding at a uniform rate. The size of these atmospheres may be deduced from the relative intensities of the red and green lines or from the red lines only. (Author)

Liege U. (Belgium).
THE (2,0) AND (3,1) BANDS OF THE RED SYSTEM OF CN, by N. Godfrind. Technical scientific note no. 1 on Contract AF 61(052)24. Feb 59, 22p. 14 refs. AFCRC-TN-59-270.
Order from LC mi$2.70, ph$4.80 PB 150 926

The red system of CN has been photographed in the first order of a 21 foot-grating in the region λ7800 - λ8300. The rotational structure of the (2,0) and (3,1) bands has been analyzed. Various constants have been determined. A comparison with cometary spectra has been published by J. Dufay and P. Swings. A comparison with the solar spectrum described by H. D. Babcock and C. E. Moore is made; 86 good coincidences occur; several previous assignments to CN appear doubtful. A convincing and definite solution of the problem of the identification of the red system of CN in the sun requires new observational and laboratory data. (Author)

Manchester U. (Gt. Brit.).
STUDIES IN LUNAR TOPOGRAPHY. IV. MEASURED PROFILES OF THE MOON'S SURFACE, AND THE ESTIMATES OF MAGNITUDES OF THE ERRORS IN RELATIVE ALTITUDE, by Gilbert Fielder. Technical scientific note no. 4 on Contract AF 61(052)168. Nov 59, 47p. 2 refs. AFCRC TN-60-268.
Order from LC mi$3.30, ph$7.80 PB 150 933

Important systematic errors in the altitudes of measured points arise because of errors in the coordinates of the peak which is casting the shadow. The aim of the first part of this note is to investigate the variation of these errors across the disk of the Moon and to estimate their magnitudes. The second part will present measured profiles of parts of the terrain lying close to the 'neck' which connects Mare Imbrium and Mare Serenitatis, and 'spot' heights of many peaks in the Caucasus Mountains. The third part gives altitude measurements made on small craters in the Hyginus region, and the note terminates with a profile in the small crater Ptolemaeus A. (Author). (See also PB 146 133).

Manchester U. (Gt. Brit.).
STUDIES IN LUNAR TOPOGRAPHY. V. A SYSTEMATIC MICRODENSITOMETRIC TECHNIQUE AND ITS APPLICATION TO FORMATIONS IN THE MARE IMBRIUM, by Thomas Rackham. Technical scientific note no. 5 on Contract AF 61(052)168. Nov 59, 40p. 7 refs. AFCRC TN-60-269.
Order from LC mi$3.00, ph$6.30 PB 150 934

The first part of this paper discusses a special application of microdensitometric techniques as used in the systematic measurement of lunar shadows obtained on 35mm ciné film at the Pic-du-Midi Observatory. The second section contains the resultant tabulated relative heights and relevant data for Aristillus, Autolycus, Piton, Archimedes C, and Archimedes ζ. Scaled diagrams of the first four objects are also included. (Author). (See also PB 150 933).

Manchester U. (Gt. Brit.).
STUDIES IN LUNAR TOPOGRAPHY. VI. MEASURED HEIGHTS OF MOUNTAINS IN THE SOUTH EASTERN PART OF MARE TRANQUILITATIS, by Geoffrey Turner. Technical scientific note no. 6 on Contract AF 61(052)168. Nov 59, 21p. 7 refs. AFCRC TN-60-270
Order from LC mi$2.70, ph$4.80 PB 150 935

Measured heights for craters in the South Eastern part of Mare Tranquilitatis are given for the western inner walls and eastern outer walls. The new values are compared with earlier determinations made by other techniques. Panoramic profiles of the apparent skyline have been made for two points in the region which illustrate the short range of visibility of features due to the moon's curvature. The Photometric determination of the gradient of gentle slopes is discussed and some results are given. (Author). (See also PB 150 934).

Manchester U. (Gt. Brit.)
STUDIES IN LUNAR TOPOGRAPHY. VII. MEASUREMENTS OF THE HEIGHT OF THE WALLS OF THE CRATER ARCHIMEDES, by Geoffrey Turner. Technical scientific note no. 7 on Contract AF 61(052)168. Dec 59, 19p. 6 refs. AFCRC TN-60-271.
Order from LC mi$2.40, ph$3.30 PB 150 936

Results are given for the measurement of negatives taken at the Pic du Midi in 1956 and 1959. The average height for the inside of the East and West walls are 1731 and 1786 meters respectively, and 1623 meters for the outside of the East wall. The present work is compared with earlier results and profiles illustrate the absence of jagged walls. (Author). (See also PB 150 935).

Minnesota U., Minneapolis.
COSMIC RAY PROGRAM. Annual progress rept. and technical repts., 1 Sep 56-1 Sep 57, on Contract Nonr-710(19). [1957] 109p. 44 refs. AD-155 313.
Order from LC mi$5.70, ph$16.80 PB 148 260

The primary alpha particle spectrum over North America and geomagnetic cutoff energies: The equivalent cosmic ray latitudes in the US are 6° higher than conventional geomagnetic latitudes, and British and Continental latitudes are 6° lower. This has great bearing on the calculation of energy spectra from observations of cosmic rays at various latitudes. Angular correlation in the decay of pions and muons: The results with about 6200 $\pi\mu$-decays show that the measured distribution is significantly different from isotropy, both in latitude and longitude. A cosmic ray jet in the 10^{15} electron volt energy range: A 22.4-1 stack of emulsions was exposed in Minnesota during Sept 1956 in a balloon flight at 116,000 ft. In the 9 radiation lengths of the Minnesota portion of the stack, the jet multiplied from 9 particles, mainly in 2 cores, to 8000 particles. Geomagnetic effects on heavy primary cosmic radiation at 42° N lat: The results indicate that the east-west effect is normal in direction, and that angular distribution, as a function of zenith angle, shows none of the shadow cone effects predicted by Schremp. Large cosmic ray

decrease accompanying solar maximum 1957: Two types of observations at balloon altitudes show a very large decrease compared with 1955 and 1956. The primary alpha particle intensity at sunspot maximum: The alpha particle data showed that a decrease occurred throughout the spectrum and that, even though both low and high energy particles are reduced in intensity, some low energy particles can still arrive. Azimuthal alpha particle distribution at Guam: Preliminary results indicated that the east-west asymmetry is not as large as expected.

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
CHARGED PARTICLE RADIATION IN SPACE, by T. R. Riethof. Aug 60, 33p. 117 refs. Technical Information Series R60SD391.
Order from LC mi$3.00, ph$6.30 PB 150 801

The charged particle radiation in space is reviewed, with particular emphasis placed on charged particles trapped in the earth's magnetic field, the "Van Allen" belts. The vehicles and techniques used in measuring the charged particle radiation are considered in conjunction with the results of some of the measurements. The data is analyzed to obtain some idea of the distribution of charged particles both with respect to location in space (latitude, and distance from the center of the Earth) and with respect to their mass and energy. A summary of some of the ideas for the origin of the Van Allen belts is included. Cosmic rays and solar flares are briefly considered. Some effects of particle radiation are briefly considered, with emphasis on their influence on space travel, and possible protective techniques. (Author).

Yale U. Observatory, New Haven, Conn.
A VERY LOW FREQUENCY RADIO EXPERIMENT FOR SATELLITE AND PROBE TRANSPORTATION, by J. N. Douglas, G. R. Huguenin, and A. E. Lilley. Final rept. on Contract AF 19(604)3059. Jan 60, 57p. 3 refs. AFCRC TR-60-210; AD-234 974.
Order from LC mi$3.60, ph$9.30 PB 148 258

Theoretical and experimental investigations were made, of the ionospheric regions above the maximum of the F_2 layer by utilizing observations of extraterrestrial low-frequency radio noise made in rocket probes and satellites. The following sources of VLF radiation are examined: general cosmic environment, synchrotron radiation, plasma and shock waves, Cerenkov radiation, parametric oscillations, free-free transitions, solar disturbances, non-thermal planetary radiation, and terrestrial disturbances. Based upon predicted VLF intensities to be expected from cosmic sources of radiation, performance specifications on the antennas and radiometers were developed. Three complete satellite payloads were constructed for rocket probe and satellite transportation. Each payload operates at 13.25, 7.0, 2.2, and 0.7 mc. Ground-based radiometers and ground-based transmitters were constructed for terrestrial correlation studies and closed-loop tests of ionospheric leakage.

BEHAVIORAL SCIENCES

Human Engineering

Aerospace Medical Div., Wright Air Development Div., Wright-Patterson AFB, Ohio.
A METHOD OF ESTIMATING SURFACE COLOR DISCRIMINABILITY FOR CODING TRAINING EQUIPMENT AND PREDICTING LABEL LEGIBILITY, by Charles E. Gustafson. Rept. on Human Factors in the Design of Training Equipment. May 60, 12p. 4 refs. WADD Technical note 60-83.
Order from OTS $0.50 PB 171 053

Using luminous reflectance values for Federal Standard colors, the classic formula for contrast is suggested as a convenient method of estimating surface color discriminability for purposes of coding training equipment and predicting the legibility of panel labels. Errors in discrimination increase as brightness contrast decreases, without regard to contrast in hue. Specific applications of the method are discussed, and conclusions are drawn concerning contrast limitations for optimum color discriminability and label legibility. (Author) (See also PB 143 821)

Quartermaster Research and Engineering Center, Natick, Mass.
QUARTERMASTER HUMAN ENGINEERING HANDBOOK SERIES: VII. THE SIZE AND SHAPE OF THE AVAILABLE VISUAL FIELD DURING THE WEARING OF ARMY HEADGEAR, by John L. Kobrick and Brian Crist. May 60, 25p. 7 refs. Technical rept. EP-133; AD-238 090.
Order from LC mi$2.70, ph$4.80 PB 148 319

This report furnishes information in tabular form on the size and shape of available visual fields during the wearing of 12 Army headgear ensembles. Schematic diagrams are also provided to aid in visualizing size and shape of the visual fields. (Author)

Aerospace Medical Div., Wright Air Development [Div.], Wright-Patterson AFB, Ohio.
TASK PERFORMANCE WITH THE CRL MODEL 8 MASTER-SLAVE MANIPULATOR AS A FUNCTION OF COLOR-CODING, DISTANCE, AND PRACTICE, by D. Frederick Baker and Billy M. Crawford. Rept. on Human Factors in Advanced Flight. Nov 59, 19p. 7 refs. WADC Technical rept. 59-728; AD-233 457.
Order from LC mi$2.40, ph$3.30 PB 152 300

This report released for sale to the public 26 Oct 60.

The ability of Master-Slave Manipulator (CRL Model 8) operators to identify the slave hands and their movements with corresponding components and functions of the human body (specifically forearm, wrist and finger movement) was investigated. A handling task involving rearrangement of blocks was devised to be performed under two different conditions: (1) with standard slave aws (red aws) and (2) with slave jaws modified so

that the jaw corresponding to the thumb of the operator was green. The task was performed at distances of 9 in., 36 inc., and 63 in. from the radiation shield. Work time as a function of task distance was investigated and work ratios, based on mean time scores for direct handling vs. remote handling, were determined. (Author).

Personnel and Training

American Inst. for Research, Washington, D. C.
OPERATIONAL ANALYSES OF THE NAVAL PERSONNEL SYSTEM PART I. DEVELOPMENT OF A PERSONNEL SYSTEM MODEL, by Richard H. Gaylord, Alfred J. Farina and Paul Spector. Final rept. on Contract Nonr-2872(00). Dec 59, 59p. 3 refs. AIR-33-59-FR-218; AD-230 545.
Order from LC mi$3.60, ph$9.30 PB 152 136

An application of the techniques of operations research to the analysis of the Navy Personnel System is described. The Personnel System is conceptualized as that portion of the Navy which is directly concerned with the information, decisions, and actions necessary to insure the availability of the right people at the right time and place to operate, maintain, and support the Naval weapons system in a maximally effective manner. The following major steps were taken in the study: (1) definition of the basic purpose of the Personnel System; (2) identification of the major functions served in accomplishing the system's basic purpose; (3) identification of the major areas of interaction between the Personnel System and other systems of the Navy; (4) identification of the major processing programs of Personnel System operations; and (5) development of a mathematical model to estimate the effectiveness of alternative personnel programs in supplying required skilled manpower. Also included is a long-range research plan for extending the general analysis of the Personnel System.

American Inst. for Research, Pittsburgh, Pa.
A SURVEY OF THE LITERATURE ON PREDICTION OF AIR FORCE PERSONNEL REQUIREMENTS, by John D. Folly, Jr., Jean B. Fairman, and Edna M. Jones. Rept. for 1955-1960 on Weapon System Qualitative Personnel Requirements and Utilization, Contract AF 33(616)6427. July 60, 388p. 121 refs. WADD Technical rept. 60-493.
Order from OTS $5.00 PB 171 075

A survey of methods for predicting personnel requirements for future Air Force weapon systems is presented with abstracts of 121 unclassified, professional documents. Emphasis is placed on identifying procedures for deriving personnel requirements information, and the supporting rationales. The current state of the art is evaluated and presented with implications for future research requirements. Conclusions from the study show that fairly thorough procedures exist for describing tasks and positions and for combining tasks into positions. However, no evidence was found of any systematic evaluation of this method. Estimating manpower requirements often has been done but only one report describes a procedure for doing this. Determining skill level requirements and criticality of tasks has received little methodological attention. Most attention has been directed toward the rating of skill levels rather than toward any objective determination of skill requirements. One exception provides a seven-point scale of operationally defined performance levels. Like the other techniques found in this survey, this one has never been evaluated. (Author)

Applied Psychological Services, Wayne, Pa.
POST-TRAINING PERFORMANCE CRITERION DEVELOPMENT AND APPLICATION: TECHNICAL PERFORMANCE CHECKLIST CRITERIA WHICH MEET THE THURSTONE AND GUTTMAN SCALABILITY REQUIREMENTS, by Arthur I. Siegel and Stephen Benson. Rept. on Contract Nonr-2279(00). Dec 59, 97p. 7 refs. AD-230 244.
Order from LC mi$5.40, ph$15.30 PB 152 142

The results of five separate but related substudies are presented: Substudies I and II investigated the hypothesis that skills are scalable in the same manner as are the attitudes and the sensory phenomena which have been previously scaled psychophysically. Three scales meeting the Thurstone criteria were developed for the skills underlying the tasks performed by the Naval aviation electronics technician. It was also shown that these scales meet the Guttman criteria of scalability. Substudy III investigated the hypothesis that the measured level of performance of aviation electronics technicians will show a positive correlation with Naval attitudes as measured through an attitudinal inventory. Little or no relationship was found to exist between Naval attitudes and fleet proficiency. Substudy IV investigated the relationship between various "predictors" and the post-training performance effectiveness of Naval aviation electronics technicians. Of the predictors investigated, no one predictor per se was found strong enough for practical individual prediction of fleet performance. Study V compared, in terms of maximum possible prediction, the power of the manifest structure analytic technique with the regression technique. The regression technique was found to be more powerful. (Author)

Psychological Lab., U. of Southern California [Los Angeles]
A STUDY OF MILITARY LEADERSHIP IN RELATION TO SELECTED INTELLECTUAL FACTORS, by Alvin Marks, J. P. Guilford, and P. R. Merrifield. Rept. no. 21 on Studies of Aptitudes of High-level Personnel, Contract N6onr-23810. Nov. 59, 26p. 50 refs.
Order from LC mi$2.70, ph$4.80 PB 150 483

This study was designed to investigate the relationship between certain intellectual-aptitude factors and military leadership. It was also designed to develop a rating scale which would evaluate the degree of display of these aptitudes within the individual military leader. It was hypothesized that eleven intellectual aptitude factors are important in military leadership: perceptual foresight, conceptual foresight, penetration, experiential evaluation, sensitivity to problems, adaptive flexibility, spontaneous flexibility, general reasoning, verbal comprehension, originality, and ideational fluency. The general criterion (leadership rating) correlated significantly with only three of the aptitude composite scores, for the factors of originality, sensitivity to problems, and verbal comprehension.

All correlations between rating and aptitude composites were very small. The individual rating items did not correlate strongly with any of the aptitude factor composites.

Psychological Research Associates, Inc., Arlington, Va.
USE OF ANALYTICAL INFORMATION CONCERNING TASK REQUIREMENTS TO INCREASE THE EFFECTIVENESS OF SKILL TRAINING, by James. F. Parker, Jr. and Edwin A. Fleishman (Yale U.) Rept. on Contract Nonr-2489(00). Dec 59, 44p. 10 refs.
Order from LC mi$3.30, ph$7.80 PB 152 123

The present report describes an approach to training design which has not received much attention. The emphasis is on the development of a training program which makes use of analytical information about specific ability requirements of the task to be learned. Two types of analytical information are used. The first involves knowledge about the abilities which contribute to individual differences in performance at different stages of training on the task in question. The second type of information is represented by knowledge of the relative contribution of the different task components to over-all task proficiency.

Psychology

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE MEASUREMENT OF CONCEPT FORMATION IN THE CHIMPANZEE AND ITS RELEVANCE TO THE STUDY OF BEHAVIOR IN SPACE ENVIRONMENTS, by Frederick H. Rohles, Jr., Richard E. Belleville, and Marvin E. Grunzke. July 60, 17p. 8 refs. AFMDC-TR-60-20.
Order from LC mi$2.40, ph$3.30 PB 150 372

This report describes a new procedure for measuring higher intellectual processes in the chimpanzee. The fully automatic equipment employed eliminates continuous monitoring by the experimenter and can be modified readily for conducting similar research during space flight. (Author)

Applied Mathematics and Statistics Labs., Stanford U., Calif.
MARKOV LEARNING MODELS FOR MULTIPERSON SITUATIONS, II. METHODS OF ANALYSIS, by Patrick Suppes and Richard C. Atkinson. Technical rept. no. 27 on Contract Nonr-225(17). 28 Dec 59, 65p. 7 refs; AD-231 213.
Order from LC mi$3.90, ph$10.80 PB 152 178

Maximum likelihood estimates for the learning parameters are considered for the case of noncontingent reinforcement and then for the 2-person interaction situation. The assumption of exactly one element in the stimulus set of each subject is required. The methods of parameter estimation are extended to models which assume more than one stimulus element. The methods resemble the maximum likelihood methods, but do not have the maximum likelihood property. A method for estimating jointly the number N of stimuli and the value Θ of the learning parameter is also considered. Various χ^2 tests are considered for testing hypotheses that the transition probabilities of a first order chain are constant, that they are specific numbers, and that the process is a u^{th} order Markov chain. Methods of estimation are also given for making an almost maximum likelihood estimate of the learning parameter. A generalized conditioning model is developed in which the single parameter Θ is replaced by several conditioning parameters. Simple maximum likelihood methods of estimation for these new parameters are derived. (Author)

Boston U., Mass.
ANNUAL TECHNICAL REPT. by Warren G. Bennis, Arthur M. Cohen, and George H. Wolkon. Rept. on Contract Nonr-492(05). [1959] 25p. 13 refs.
AD-229 368.
Order from LC mi$2.70, ph$4.80 PB 152 103

The effects of continued practice on the behaviors of problem-solving groups: Groups were assigned to 2 experimental conditions. The Wheel pattern was more structured and hierarchical. The Circle pattern had equal communication opportunities and was less restricted. Learning continued to take place in both patterns longer than expected, and was of two major kinds: (a) a division of labor in the form of stable answer and information exchanges; and (b) progressively more efficient operations within such divisions. The rate of learning in the Wheel groups was faster than that of the Circles, and they reached a point of optimal efficiency while the Circles did not. Wheels also had more correct trials, fewer changes, and fewer final errors. The effects of changes in communication patterns on the behaviors of problem-solving groups: Groups were under 4 experimental conditions: (a) Circle-to-Wheel (CW); (b) Wheel-to-Circle (WC); (c) Circle-to-Circle (CC); and (d) Wheel-to-Wheel (WW). This made it possible to study how problem-solving groups behaved when changed from a condition of greater to one of less hierarchy and restriction and vice versa, as compared to groups which had not experienced changes in patterns. WC groups took shorter times to solve problems and had more correct trials than CC groups, while CW groups took longer times to solve problems than WW groups but did not have fewer correct trials. It was found that training was transferred from one pattern to another. The WC groups were more generally satisfied than the CC groups. CW groups showed decreases in satisfaction under conditions of restricted decision-making.

California U., Los Angeles.
A BIBLIOGRAPHY OF PUBLICATIONS RELATING TO THE SMALL GROUP, by Bertram H. Raven. Technical rept. no. 1 on Dynamics of Social Influence, Contract Nonr-233(54). Nov 59, 119p. 1445 refs.
Order from LC mi$6.00, ph$18.30 PB 150 498

A bibliography of 1445 articles and books relating to the small group is presented, with index. Also included is a discussion of a punch-card coding system for the bibliography, together with suggestions for the establishment and use of such a system. (Author)

California U., Los Angeles.
AN OPERATIONAL DISTINCTION BETWEEN BELIEF AND ATTITUDE, by Martin Fishbein and Bertram H. Raven. Technical rept. no. 2 on Dynamics of Social Influence, Contract Nonr-233(54). 4 Dec 59, 22p. 16 refs. AD-233 352.
Order from LC mi$2.70, ph$4.80 PB 152 104

Stemming from Osgood's analysis of attitude through his semantic differential, a scale was developed which permits an operational distinction between belief and attitude. Attitude is defined as the evaluative dimension of a concept, belief as the probability dimension ("Is it probable or improbable?"). The adjective pairs that serve to discriminate these two dimensions were empirically determined through the use of a role-play procedure. The AB scale, thus developed, was then tested for generalizability, and for independence of dimensions, and proven useful. Beliefs and attitudes were independently manipulated. The relationship between this finding and those of prior investigations is discussed. (Author)

Fels Group Dynamics Center, U. of Delaware, Newark.
PERCEPTION VARIABLES AND COMMUNICATION EFFICIENCY, by John T. Lanzetta. Annual progress rept. no. 2, 15 Nov 58-15 Nov 59, on Contract Nonr-2285(02). [1960] 9p.
Order from LC mi$1.80, ph$1.80 PB 150 472

Selected personality, group, and situational variables were examined in terms of their effects upon the characteristics of emitted messages and the acceptance of transmitted messages. Five studies were completed during the year and one other study is currently being designed. The exploratory studies fall in two general areas. One area investigated is concerned with characteristics of transmitted and desired information as a function of personality attributes of the source and conditions of group interaction. Related to this latter area was a study in which visual interaction was conceptualized as a form of communication activity. Another area, dealing with the acceptance, retention and categorization of messages under specified conditions of source and medium, has been studied.

Illinois U., Urbana.
INTERPERSONAL PERCEPTION AND INTERPERSONAL RELATIONSHIPS IN THERAPEUTIC COUNSELING, by Rolfe LaForge. Annual rept. no. 3 on Contract Nonr-1834(11). 15 Nov 59, 38p. 4 refs. AD-230 445.
Order from LC mi$3.00, ph$6.30 PB 150 490

Ratings were obtained of interview recordings of interpersonal communication in the therapeutic situation, and were used as criteria in the investigation of the D^2-statistic, which measures the dissimilarity between two sets of ratings on corresponding items. The relatively large correlations found between D^2's calculated for presumably independent variables was studied, and Q-correlations were calculated for each subject and intercorrelated with other components. An investigation was also conducted of the relationship between clients' ratings of counselors and the latter's ratings of therapeutic outcome. It was found that interpretations based on D^2 alone can be considerably sharpened by comparing the behavior of the components of elevation and the tendency to use extremes in ratings made by hospitalized patients and community persons. (See also PB 143 434)

Institute for Applied Experimental Psychology, Tufts U., Medford, Mass.
VISUAL FACTORS AFFECTING EFFICIENCY IN THE TASK OF PHOTOINTERPRETATION, by Mason N. Crook. Annual summary rept. on Contract Nonr-494(17). Dec 59, 10p. 12 refs. AD-232 175.
Order from LC mi$1.80, ph$1.80 PB 152 107

Factors affecting visual performance in photointerpretation are outlined. These are (1) factors related to the operator; and (2) factors related to work spaces, materials, and equipment. The following specific problems were discussed: (1) general illumination, (2) illuminants for colored transparencies; (3) differential illumination in stereo viewing; (4) binocular viewing of duplicate photographs; and (5) visual fatigue. A work situation is being developed to impose visual stresses analogous to those which might occur in photointerpretation. The task being used is reading of printed material, which is positioned in duplicate in the instrument and fused by the subject. Preliminary experiments indicate that the following processes are interacting: (1) learning; (2) adaptation; (3) blocking; and (4) fatigue.

Israel Inst. of Applied Social Research.
FACET DESIGN AND ANALYSIS OF DATA ON PERSONALITY AND ATTITUDES RELATED TO HUMAN ORGANIZATION, by Uriel G. Foa and Louis Guttman. Technical summary rept. for 1 June 58-31 May 60 on Contract AF 61(052)121. [1960] 36p. 8 refs. AFOSR-TN-1008.
Order from LC mi$3.00, ph$6.30 PB 150 361

The present research project is devoted to problems of content, statistical structure, and deductive metatheory for special areas of empirical data on human organization and personality. Three levels of content problems are discussed in the present report. In view of the importance of concept classification in scientific development, a three structure for the classification of behavioral data has been developed. This constitutes the most general level; the suggested structure is formal, but it provides a framework for the classification of the facets of a specific study. Finding facets which will predict the statistical structure of a given set of variables exemplifies the most specific approach to the content problem. Proceeding from these two extremes toward the middle it may be possible to develop facets for a specific behavior area, rather than for a single study. This has been done for the analysis of interpersonal behavior.

Kansas U. School of Pharmacy, Lawrence.
THE DOSE-EFFECT AND DURATION OF ACTION OF SEVERAL CNS STIMULANTS ON MOTOR AND PSYCHOMOTOR PERFORMANCE, by Duane G. Wenzel and Charles O. Rutledge. Technical rept. on Contract Nonr-583(09). 23 Dec 59, 28p. 24 refs. AD-230 246.
Order from LC mi$2.70, ph$4.80 PB 152 098

Studies were made in an attempt to evaluate the effects central nervous system stimulants have on human performance. The tests employed measured several components of what may be regarded as total psychomotor performance. No attempt was made to directly evaluate the subjective or behavioral effects of the drugs in question, although such effects undoubtedly

influenced the results obtained. The tests employed were concerned primarily with motor response and did not permit adequate judgment of overall performance. Certain findings did appear to be worthy of consideration. Caffeine, for example, was usually most effective at the lowest dose. The response patterns with this drug gave reason to suspect that if the dose were to be increased beyond the 300 mgm maximum, the level of performance could fall below that obtained with placebos. In general, phenmetrazine and methylphenidylacetate were more effective in the dose ranges tested than was d-amphetamine. The marked deterioration of performance in the choice reaction test produced by the 50 mgm dose of phenmetrizine may indicate some impairment of mentation.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
REMEMBERING THE PRESENT STATES OF A NUMBER OF VARIABLES, by D. B. Yntema and G. E. Mueser. Rept. on Contract AF 19(604)5200. 16 Mar 59, 13p. 5 refs. Group rept. 58-2.
Order from LC mi$2.40, ph$3.30 PB 150 975

The subject attempted to remember the present states of 2, 3, 4, 6, or 8 variables. He was read a series of messages, each saying what state one of the variables had assumed, and recorded each message on a status board. It was found that the fraction of the questions answered correctly decreases as the number of variables increases and, if there are more than two variables, is lower when they represent one attribute of several objects than when they represent several attributes of one object. The probability that a particular question would be answered correctly was found to be influenced by (a) the number of questions and messages intervening between the question under consideration and the message that determined its correct answer, (b) whether any of those intervening items were questions about the same variable, and (c) whether the message that determined the correct answer was the same as the previous message about the same variable. Sources of error variance were considered. A few implications for the design of control centers are discussed in a separate section.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
REMEMBERING THE PRESENT STATES OF A NUMBER OF VARIABLES: III. WHY IT IS DIFFICULT TO KEEP TRACK OF SEVERAL VARIABLES WITH THE SAME SET OF STATES, by D. B. Yntema and G. E. Mueser. Rept. on Contract AF 19(604)5200. 17 Aug 60, 13p. 2 refs. 58 G-0013.
Order from LC mi$2.40, ph$3.30 PB 150 369

Keeping track of the current states of a number of variables has been found to be more difficult in the case where the variables are the same attribute of several nonsensical objects (in which case all variables have the same set of states) than in the case where the variables are different attributes of one nonsensical object (in which case each variable has its own distinct set of states). The present experiment showed that the difference may be ascribed entirely to the fact that S cannot identify the variable from the name of its current state in the single-attribute case; explanations involving interference among the items to be remembered are unnecessary. The present experiment also compared the tasks of keeping track of six attributes of one object, three attributes of two objects, two attributes of three objects, and a single attribute of six objects. Performance was found to deteriorate in a regular fashion as the number of attributes per object decreases. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
A THEORY OF COGNITIVE PROCESSES, by Ulric Neisser. Rept. on Contract AF 19(604)5200. 23 Feb 60, 22p. 27 refs. Group rept. 54-19.
Order from LC mi$2.70, ph$4.80 PB 150 794

Louisiana State U., Baton Rouge.
TEST OF A PROPOSED THEORY OF LEADERSHIP, Bernard M. Bass. Annual rept. no. 5 on Behavior in Groups, Contract N7onr-356(09). 15 Nov 59, 8p. 6 refs. AD-229 624.
Order from LC mi$1.80, ph$1.80 PB 150 542

See also PB 143 422

Massachusetts U., Amherst.
PAIRED-ASSOCIATES LEARNING AND PERFORMANCE AS FUNCTIONS OF OCCURRENCE OF RESPONSE MEMBERS (REINFORCEMENT) AND OF STIMULUS CHARACTERISTICS, by Albert E. Goss, Harvey A. Taub, and Bruce N. Gregory. Technical rept. no. 1 on Contract Nonr-2691(00). Nov 59, 30p. 9 refs. AD-230 535.
Order from LC mi$2.70, ph$4.80 PB 150 503

Massachusetts U., Amherst.
PAIRED- ASSOCIATES LEARNING WITH VARYING RELATIVE PERCENTAGES OF OCCURENCES OF ALTERNATIVE RESPONSE MEMBERS, by Marilyn E. Sugerman and Albert E. Goss. Technical rept. no. 2 on Contract Nonr-2691(00). Nov 59, 43p. 17 refs. AD-230 536.
Order from LC mi$3.30, ph$7.80 PB 150 504

Paired-associate learning was investigated with units which had 2 rather than a single response unit. The relative percentages of occurrence of alternative response members of paired-associate units and of the number of paired-associate units is described. In order to control for effects of time intervals between successive presentation of the same unit, there were 3 conditions of presentation: (1) a constant 3-sec interval between successive presentations of a unit; (2) longer, variable intervals between successive presentations of a unit; and (3) longer, variable intervals filled with presentations of randomly-paired stimuli. There was a direct relationship between mean percentages of anticipation of the more frequent response members and the actual percentages with which those members occurred. During the last 3 blocks of trials, the interaction of relative percentages and conditions was significant. The significance of these findings for the experimental formation of response hierarchies was also noted.

New York U., N. Y.
PSYCHOLOGICAL STUDY OF MOTOR SKILLS: PHASE I, by Lawrence Karlin. Rept. on Contract N61339-558. 2 July 60, 51p. 15 refs. Technical rept. NAVTRADEVCEN 558-1.
Order from LC mi$3.60, ph$9.30 PB 150 639

The present study was concerned with comparing the effectiveness of different types of cue on the learning and retention of a simple motor skill (rate of crank-turning). In addition, it studied the effectiveness of a preliminary lecture and of intermittent presentation of these cues. In all, thirteen conditions were studied using as many independent groups of ten subjects each. The results showed no clear superiority in acquisition or retention for any one of the single cues. There was a definite suggestion, however, confirmed by one significant finding, that the visual cue was generally superior in acquisition and inferior in retention to the other cues. The data also suggested that individual habits of learning might have interacted with the various types of cue to produce differences in acquisition and retention. The effect of using various combinations of cues were also explored. The combinations differed significantly in acquisition and seemed to divide themselves into groups in which the verbal, verbal-kinaesthetic and auditory-kinaesthetic were superior in both acquisition and retention to the audio-visual and kinaesthetic-visual groups. No statistically significant differences in performance were found from the use of either a lecture or an intermittent mode of presentation.

Ohio State U. Research Foundation, Columbus.
ORIGINALITY IN GROUP PRODUCTIVITY, by Pauline N. Pepinsky and Harold B. Pepinsky. Annual summary rept. 16 Nov 58-15 Nov 59, on Contract Nonr-495(15). 15 Nov 59, 8p. 6 refs. RF Proj. 798, rept. no. 8; AD-229 372.
Order from LC mi$1.80, ph$1.80 PB 150 859

This research is directed toward the identification and measurement of behaviors that are independent and original but contribute to group productivity; and the determination of conditions leading to such behaviors, and the experimental testing of such effects. (See also PB 144 851).

Research Center for Group Dynamics, U. of Mich., Ann Arbor.
STUDIES ON DRIVE AND INCENTIVE IN PERCEPTION. II. THE EFFECT OF DRIVE PRODUCED BY PROPNOCEPTIVE STIMULATION ON GENERALIZED RESPONSES TO LOUDNESS AND PITCH, by Arnold H. Martin. Technical rept. no. 6 on Contract AF 49(638)367 and National Science Foundation Grant G-4951. July 60, 34p. 32 refs. AFOSR TN-60-1054.
Order from LC mi$3.00, ph$6.30 PB 150 638

This study represented an attempt to determine the validity of the hypothesis that perceived stimulus intensity is a function of drive multiplied by the physical stimulus intensity. The effects of proprioceptive stimulation on generalization gradients along qualitative and quantitative dimensions were investigated. The findings regarding the quantitative dimension gradients were consistently opposite to what had been predicted. The predictions concerning the qualitative dimension gradients were in general confirmed. Explanations both within and outside the D x S framework were set forth to account for the significant reversal of the expected effect of drive on the quantitative dimension gradients. (Author) (See also PB 146 641)

Rutgers State U., New Brunswick, N. J.
HOMEOSTASIS THEORY OF SMALL GROUPS III, by F. K. Berrien and William H. Angoff. Technical rept. no. 4 on Contract Nonr-404(10). Mar 59, 14p.
Order from LC mi$2.40, ph$3.30 PB 148 268

The homeostasis theory of small groups suggests that if a disturbance occurs which would tend to lower either Formal Achievement (F. A.) or the Group-Need Satisfactions (G. N. S.) some sort of compensatory effect will occur within conditions predicting F. A. or G. N. S. so that these latter criteria will remain stable. This hypothesis was tested by an analysis of attitude survey data taken from telephone operators in 32 exchanges. The analysis neither supports nor refutes the hypothesis. Instead it suggests that more predictors are necessary for a definitive test of the hypothesis. (Author) (See also PB 142 092)

[Small Groups Research Center] Washington U. [St. Louis, Mo.]
AMBIGUITY AND THE RATE OF SOCIAL ADAPTATION, by Robert L. Hamblin and James A. Wiggins. Technical rept. no. 1 on Contract Nonr-[816(11)]. Nov 59, 20p. 10 refs. AD-228 635.
Order from LC mi$2.40, ph$3.30 PB 150 851

A theory involving ambiguity of cues, the disruption of utility and non-utility discrimination processes, and the rate of social adaptation as evidenced by the frequency of ritualistic and innovative behavior during a period of disequilibrium was investigated. Two hypotheses were developed and tested. As predicted, groups who experienced ambiguity of cues regarding the loss of utility during the disequilibrium period and groups who experienced ambiguity of cues regarding presence of utility prior to the disequilibrium period engaged in more ritualistic behavior and less innovative behavior than groups which did not experience ambiguity either before or during disequilibrium. In addition, there were 2 unanticipated results of the experiment: (1) Deese's theory that ambiguity during a learning period inhibits adaptation by disrupting the discrimination processes was given some direct support; and (2) the data indicate that the model developed in connection with the theory should be modified in one respect, as the inertia phase of this disequilibrium period was typically and unexpectedly interwoven with the search phase. Although statistically significant, the differences were not huge. The suggestion is that ambiguity may be one of several variables which may account for variations in the rate of social adaptation. (Author)

Small Groups Research Center, Washington U., St. Louis, Mo.
STRUCTURAL FACTORS AND INDIVIDUAL NEEDS IN GROUP BEHAVIOR, by Richard deCharms and Robert L. Hamblin. Annual technical rept. on Contract Nonr-816(11). Nov 59, 12p. 5 refs. AD-228 638.
Order from LC mi$2.40, ph$3.30 PB 150 852

Contents:
Structural factors in group behavior, by R. L. Hamblin
Interaction and coalition patterns, influence, and group size
The effects of balanced and imbalanced cross linkages
Situational ambiguity and social adaptation
Competence and morale
Individual need in the group situation
Studies in vicarious satisfaction-I: Aggression and hostility, by R. deCharms
Studies in vicarious satisfaction-II: Catharsis, self-esteem and reduction of hostility, by R. deCharms and E. J. Wilkins
Studies in vicarious satisfaction-III: An attempt to reconcile experiments I and II, by R. deCharms, E. J. Wilkins and D. Smith
Studies in vicarious satisfaction-IV: Task completion and satisfaction, by R. deCharms and E. J. Wilkins
Status revocability, self-esteem and social conformity by R. deCharms and M. E. Rosenbaum
Achievement and affiliation motivation in the classroom, by W. J. Bridgeman and R. deCharms
The development of affiliation motivation, by H. Gall and R. deCharms

Utah U., Salt Lake City.
VARIABLES RELATED TO ACCURACY IN INTERPERSONAL PERCEPTION, by Victor B. Cline and James M. Richards, Jr. Annual rept. no. 2 on Contract [Nonr 1288(04)]. 15 Nov 59, 25p. 26 refs. AD-230 538.
Order from LC mi$2.70, ph$4.80 PB 150 475

Seven cross validations and replications were made to see if earlier findings suggesting that judging ability was to some degeee a general trait would hold up. A large scale testing program was conducted using 295 college students to determine what the external test correlates of judging ability might be. Using patients (and some staff) in 2 state mental hospitals, an attempt to relate type of diagnosis, age, sex, education, etc. to judging ability was studied. Comparisons with normals were also made. An investigation of the behavioral correlates of judging ability was made by having members of test groups participate in comprehensive "self" and "other" rating procedures, and relating these variables to judging ability. A comparison of the accuracy of judgments of individuals vs. groups (where group members collaborate in decision and judgment making) was also made. (Author)

Washington U., St. Louis, Mo. School of Medicine.
THE EFFECT OF ELECTROCONVULSIVE SHOCK ON MALE ALBINO RATS WITH EXPERIMENTALLY INDUCED SENSORY DEFICITS, by John A. Stern and David G. McDonald. Technical rept. on Contract Nonr-816(06). 1 Dec 59, 20p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 152 101

Previous work has led to the hypothesis that a series of electroconvulsive shock produces an increase in reactivity to a variety of environmental stimuli. The evidence for the hypothesis of increased reactivity is to date more inferential than objective. There has been a need for a decisive test of this hypothesis and such is the intent of the present investigation. (See also PB 144 182)

Washington U. [St. Louis, Mo.]
EMERGENT LEADERSHIP AND SOCIAL INFLUENCE, by E. P. Hollander. Rept. on Variables Underlying Group Expectancies and Leadership, Contract Nonr-816(12). Dec 59, 21p. 33 refs. AD-232 745.
Order from LC mi$2.70, ph$4.80 PB 152 111

Attention was directed toward leaders deriving status from followers who may accord or withdraw it in an essentially free interchange within a group context. Group consent was a central feature of the leader-follower relationship. The effects upon influence acceptance produced by the nonconformity to procedural norms of a task competent member were tested. Twelve groups, each composed of male students were engaged in a task involving a sequence of 15 trials requiring group choices from among row alternatives in a 7 by 7 pay-off matrix. The alleged object was to anticipate a system and maximize winnings. A confederate, always the same individual, irrespective of treatment, was presented in all groups as a fifth member among 4 subjects. All communication was carried out through a sound-system of microphones and headsets. The participants had only aural contact with one another. Findings indicated that the task competent follower who conforms to the common expectancies of the group at one stage of time may become the leader at the next stage of time. And correspondingly, the leader who fails to fulfill the expectancies associated with his position of influence may lose credit among his followers and be replaced by one of them.

BIOLOGICAL SCIENCES

California U., Los Angeles. School of Medicine.
NERVOUS CONTROL OF SHIVERING, by Allan Hemingway. June 60, 9p. 1 ref. AAL Technical rept. 58-22.
Order from LC mi$1.80, ph$1.80 PB 150 216

Measurements of oxygen consumption rate of shivering and non-shivering animals before lesion was produced indicate that the metabolic response of shivering caused by decreasing rectal temperature by cold and anesthesia and returning to a warm environment is similar to the metabolic response caused by a cold environment without decrease of rectal temperature. In both tests shivering increases oxygen consumption rate 3.5 to 4.0 times the so-called "basal" value.

Colorado U. [Boulder]
MAGNETIC SUSCEPTIBILITY OF SINGLE BIOLOGICAL CELLS, by S. J. Gill and M. Downing. Annual progress rept. for 1 June-1 Dec 59 on Contract Nonr-1147(08). 27 Nov 59, 7p.
Order from LC mi$1.80, ph$1.80 PB 150 527

A method for calibrating the force properties of an inhomogeneous magnetic field was put into operation. The method is one used in molecular beam work, and is based upon determining the deflection of a quartz fiber, to which a piece of platinum or bismuth wire has been attached. The magnetic field may be probed and mapped by such a device. An electromagnet which

was designed to produce an inhomogeneous field was calibrated with the test probe. A simple optical system and sample container were incorporated into the magnet. Particles of the range of 8 to 30 microns have been examined. Some preliminary tests on suspended blood cells have indicated that measurements are feasible, but a constant current supply is required as the deflections of the blood cells is considerably slower than that of the latexes. Improvement of the observation of the particles has proceeded in a separate fashion. A phase contrast microscope was acquired and is being adapted to observe a small region between the magnet poles. Since spacial requirements severely limit the size of the magnet which can be easily placed into the microscope, a design of a permanent magnet has been considered and built for use with the microscope. Some preliminary tests have been made on the field gradient product and have shown values of 2×10^8

Karolinska Institutet, Stockholm (Sweden).
CONTINUED STUDIES ON NEW AND IMPROVED ELECTROPHORETICAL METHODS FOR THE ISOLATION AND PURIFICATION OF BIOLOGICALLY ACTIVE COMPONENTS OF BACTERIAL CELLS, by Berndt Malmgren. Final technical rept. for Nov 58-Nov 59 on Contract DA 91-591-EUC-948-OI-1059-59. [1959] 17p. 3 refs. AD-231 368.
Order from LC mi$2.40, ph$3 30 PB 148 269

Large scale cultivation of virulent hemophilus pertussis was carried out. Disruption of the cells in the frozen state in a modification of Hughes press followed. A new method for the removal of water from protein solutions was devised, based on the capacity of carboxymethylcellulose (CMC) in the dry state to attract water across a dialysis membrane. Cells could be brought into solution completely because the residue remaining after salt extraction could be dissolved in water to form a stable, lyophile suspension. This residue amounted to about 1/5 of the dry weight of the starting material. It had an immunogenic activity corresponding to at least 50% of that which could be demonstrated if the material was tested in the common vaccines form. The fraction which was lipopolysaccharide-protein in character could be freeze-dried without loss in activity of solubility. Neurotoxic activity was demonstrated in a protein fraction which did not contain nucleic acids. Chromatography of the fraction showed that the neurotoxic activity was concentrated in two distinct peaks. Both peaks also contained some dermatonecrotic activity. The tendency of the neurotoxin to combine with other proteins and perhaps also with nucleic acids makes its isolation rather difficult. In long distance electrophoresis the neurotoxin was adsorbed by the cellulose and/or inactivated. (Author)

Pacific Science Board, National Research Council, Washington, D. C.
THE VEGETATION OF MICRONESIA: PART 1, by F. R. Fosberg. Rept. on Scientific Investigations in Micronesia, 1949-, Contract N7onr-291(54). 8 Dec 59, 176p. 43 refs. SIM rept. no. 25; AD-236 461.
Order from LC mi$8.10, ph$27.30 PB 147 100

Contents:
Essay on the nature of vegetation
General description of Micronesian vegetation
Location and nature of Micronesia
Major climatic and topographic features
Map showing climatic and geologic lines
Classification of vegetation
Outline of Micronesian vegetation
Vegetation types as practical indicators
General description of vegetation types
Mangrove formation
Strand
Vegetation of raised coral limestone
Vegetation of rough lava flows
Casuarina forest
Coconut plantations
Vegetation of coastal plains
Lower primary forest
Secondary forest on slopes
Montane rain forest and cloud forest
Dwarf vegetation on open crests
Savanna or grassland vegetation
Vegetation of the Marianas Islands
The Northern Marianas--general
The Southern Marianas--general
General picture of Guam vegetation

Anatomy and Physiology

Arctic Aeromedical Lab., Ladd AFB, Alaska
CARDIOVASCULAR EFFECTS OF REFEEDING STRESS FOLLOWING STARVATION V. THE EFFECTS OF REFEEDING PURE GLUCOSE, by B. Conner Johnson and Vincent Fiorica. Jan 59, 22p. 4 refs. Technical note AAL-TN-59-18.
Order from LC mi$2.70, ph$4.80 PB 152 028

This note presents the results of feeding pure glucose, of feeding glucose plus sodium chloride, and of feeding a diet that is high in glucose to pigs starved for a long period. Cardiovascular changes occurring during pure fat refeeding have been presented in a previous report (PB 150 024).

Arctic Aeromedical Lab., Ladd AFB, Alaska.
CARDIOVASCULAR EFFECTS OF REFEEDING STRESS FOLLOWING STARVATION VI. STARCH REFEEDING VERSUS GLUCOSE REFEEDING, by M. S. Mameesh and B. Connor Johnson. Oct 59, 11p. 5 refs. Technical note AAL-TN-59-19.
Order from LC mi$2.40, ph$3.30 PB 152 029

This note presents the results of feeding two carbohydrates differing in digestibility to pigs starved for a short period (6-8 days). Cardiovascular changes occurring during pure-glucose refeeding have been presented in a previous report (PB 152 028).

Arctic Aeromedical Lab., Ladd AFB, Alaska.
CARDIOVASCULAR EFFECTS OF REFEEDING STRESS FOLLOWING STARVATION VII. REFEEDING FOLLOWING SHORT-TERM STARVATION PERIODS, by G. S. Smith, M. S. Mameesh, and B. C. Johnson. May 60, 15p. 4 refs. Technical note AAL-TN-60-8.
Order from LC mi$2.40, ph$3.30 PB 152 030

This report concerns the effects of refeeding with pure protein, pure fat, and glucose plus sodium chloride following short-term (6-8 days) starvation periods. The four pigs which have been described in previous reports were used in these experiments. (See also PB 150 024, PB 152 028, PB 152 029).

Arctic Aeromedical Lab., Ladd AFB, Alaska.
CARDIOVASCULAR EFFECTS OF REFEEDING STRESS FOLLOWING STARVATION VIII. LONG-TERM EFFECTS OF FEEDING-REFEEDING EPISODES, by G. S. Smith, M. S. Mameesh and B. C. Johnson. May 60, 16p. 2 refs. Technical note AAL-TN-60-9.
Order from LC mi$2.40, ph$3.30 PB 152 031

This report is concerned with the effects of pure nutrient refeeding following a long-term starvation; the response to increased level of natural diet following the pure nutrient feeding phase; some general aspects of repeated starvation-refeeding episodes, and the possibility of "carry over" effects from episode to episode; and the results of gross examination of the cardiovascular systems of the pigs, post mortem. (Author). (See also PB 152 030)

Artic Aeromedical Lab., Ladd AFB, Alaska.
THE CONSTRUCTION OF A SMALL MERCURY STRAIN GAUGE, by C. J. Eagan. Rept. on Public Health Service Training Grant HTS 5147 and Contract AF 41(657)216. Aug 60, 10 refs. Technical note AAL-TN-60-14.
Order from LC mi$1.80, ph$1.80 PB 152 033

The construction of a small, low-tension, mercury strain gauge is described. Dimensions of the active portion are approximately 45 mm in length and 1.25 mm in diameter. It can be used for essentially isotonic measurement of physiological change in linear dimension of any part to which it can be securely attached; it is particularly suitable for plethysmography of the human finger and the rabbit ear. If connected in a suitable circuit, the following specifications can be achieved: (a) high sensitivity; changes in length of the gauge of 1 micron can be recorded; (b) useable under conditions of changing temperature or pressure within the whole range of these environmental factors which tissue can endure. (Author).

Arctic Aeromedical Lab., Ladd AFB, Alaska.
EFFECT OF COLD ON THE ISOLATED PERFUSED MAMMALIAN HEART, by Benjamin G. Covino and Adam Resendez. June 60, 23p. 20 refs. Technical rept. 57-38.
Order from LC mi$2.70, ph$4.80 PB 150 218

The effect of cold on the properties of cardiac tissue was studied in the intact and isolated heart of the rabbit. A progressive depression of rhythmicity, conductivity, and excitability occurred as the heart temperature was lowered. Contractile force increased significantly as temperature fell to 20°C. Below this point, the force of contraction diminished sharply. All electrical and mechanical activity ceased at a mean temperature of 14.1°C. in the isolated heart and 15.4°C. in the intact rabbit. Coronary flow was reduced by a factor of 57%.

Army Chemical Research and Development Labs., Army Chemical Center, Md.
EYE PROTECTION AGAINST HIGH-SPEED MISSILES, by George M. Stewart. Rept. for Oct 56-May 60 on Wound Ballistics. July 60, 24p. 3 refs. Technical rept. CRDLR 3007.
Order from LC mi$2.70, ph$4.80 PB 152 001

This report deals with the resistance to penetration of the rabbit eye and lenses by spheres, cubes, and cylinders in the weight range of 4.1 to 14,645 mg. Rabbits varying in age from 5 to 7 months were killed and the eyes removed and mounted in gelatin for ballistic evaluation. Lenses included unheat-treated glass, heat-treated glass, laminated glass, and plastic, CR-39 Allyl casting. Lenses were in 2-base curves: 9 and 12 and three thicknesses: 2.5 mm, 3.0 mm, and 3.5 mm. Lenses under test were mounted in a specially constructed rubber jig. Based on test results, it is suggested that under those working conditions in which the eyes may be subjected to impacts of very small missiles, of less than 2-mm diameter, that protective lenses made of either plastic, laminated, or unheat-treated glass be used. For the greatest over-all protection of the eyes, plastic lenses would seem to be the first choice. (Author)

Army Chemical Research and Development Labs., Army Chemical Center, Md.
PRELIMINARY TEST OF APPARATUS FOR RECORDING INHALATION DURING THE MASKING REACTION IN THE FIELD, by W. V. Blevins, H. M. Frankel, and F. N. Craig. Rept. for Aug 59 on Basic and Applied Physiology. July 60, 30p. 15 refs. Technical rept. CRDLR 3013.
Order from LC mi$2.70, ph$4.80 PB 152 002

The first 5 units of the breath-recording system developed for the CARAMU program were tested on 7 days with 5 enlisted men from the medical volunteer detachment. Of the 35 trials, 21 complete records were obtained. In general, the recording system was satisfactory, and the failures arose mainly from the remote-control components. The apparatus did not interfere with the masking reaction. Both good and bad control of breathing during the masking reaction are illustrated. Volumes of individual breaths have been tabulated and calculations of dose inhaled made from sample concentration histories. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
HORMONAL DETERMINANTS OF MAMMALIAN TOLERANCE TO ACCELERATION STRESS, by B. David Polis and Anne Zella. Rept. no. 2 on Proj. MR005.15-0002.7; Proj. TED ADC RS-7045 (5915-M). 12 Aug 60, 15p. 7 refs. NADC-MA-6025.
Order from LC mi$2.40, ph$3.30 PB 150 44?

The pituitary-adrenal hormonal axis has been implicated as a critical factor in the survival of the rat to acceleration stress. The physiological endpoint for the tolerance of animals to high positive acceleration stress was obtained by determining the time to reduce the heart rate from eight to two beats per second at 20 G. With this technique a significant increase (300 percent) in the survival time of rats to 20 G was

found following hypophysectomy. A significant loss (60 percent) of tolerance to high acceleration stress was found in adrenalectomized rats. The procedures of hypophysectomy and adrenalectomy essentially cancelled the effect of each operation alone in the rat to yield an animal approximately similar to the normal rat in its ability to tolerate acceleration. Possible mechanisms for these effects are offered. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
NADC BIOLOGICAL INSTRUMENTATION SYMPOSIUM OF 10 DECEMBER 1958, by R. Jensen, J. J. Gordon and others. Letter rept. no. 6 on Projects MR 005.15-0002.2, TED ADC AE 1412.1 and TED NAM AE 1403.1. 5 July 60, 10p. 1 ref. NADC-MA-L6018.
Order from LC mi$1.80, ph$1.80 PB 150 439

The present communication constitutes a summary of the investigations carried out on three types of respiration sensor systems which have been developed and evaluated at the Aviation Medical Acceleration Laboratory (AMAL) during the past nine months.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
NADC BIOLOGICAL INSTRUMENTATION SYMPOSIUM OF 10 DECEMBER 1958, by R. Jensen, J. J. Gordon and others. Letter rept. no. 7 on Projects MR 005.15-0002.2, TED ADC AE 1412.1 and TED NAM AE 1403.1. 13 July 60, 8p. 7 refs. NADC-MA-L6021.
Order from LC mi$1.80, ph$1.80 PB 150 440

This is a preliminary report of tests carried out on the Aviation Medical Acceleration Laboratory (AMAL) Bioinstrumentation package during which six channels were transmitted on an assigned frequency of 232.4 megacycles from the package mounted in the AMAL centrifuge gondola to the AMAL monitoring and recording system.

California Inst. of Tech., Pasadena.
FACTORS STIMULATING PRODUCTION OF HEMOGLOBIN AND RED CELLS. Final rept. on Contract Nonr-220(09). 23 Nov 59, 4p. 5 refs.
Order from LC mi$1.80, ph$1.80 PB 150 854

Since the last progress report the following has been accomplished. Unboiled plasma, whether normal or anemic, provokes in heterologous species the formation of antibodies and this process is associated with a drop in hemoglobin and red cell count and thus, when anemic plasma is used, it erythropoietic effect is masked. Boiling (even heating to 75°) destroys the antigenic character of the plasma, even though much protein may remain in solution or suspension. The erythropoietic factor resists boiling and it was found (in boiled plasma filtrates) that it had no species specificity. Anemic rabbit plasma filtrate was active in rats and mice; dog plasma filtrate was active in mice. (See also PB 138 650).

Institute for Applied Experimental Psychology, Tufts U., Medford, Mass.
THE FEASIBILITY OF USING THE EYE AS A SOURCE OF CONTROL SIGNALS IN TRACKING, by Philip B. Sampson, Paul D. Coleman, and Edwin H. Elkin. Rept. on [Contract Nonr-494(16)] Dec 59, 43p. 43 refs. AD-231 516.
Order from LC mi$3.30, ph$7.80 PB 152 138

The idea that eye movements could be made to produce signals which could be used for machine control purposes was considered from the point of view of its feasibility. Findings indicate that (1) there are situations in which the use of the eye as a control mechanism would appear to be advantageous; (2) extremely fine eye movements can be detected by the more sophisticated laboratory techniques; (3) a class of eye movement detection devices, called mechanical-electrical techniques, seem to offer some advantages for the construction of a practical general purpose eye movement control; (4) what is known of the tracking characteristics of the eye is not inconsistent with the notion that the eye could be used as a tracking device; (5) a practical eye movement control device should impose as little restriction to the movements of the operator as possible; (6) best tracking performance with an eye movement control would probably be found for a zero-order, lag-free system with a pursuit type display; and (7) it is doubtful that the advantages found with manual control systems for first and second order controls, compensatory displays, quickening and manipulation of the C/D ratio could be realized with an eye movement control. (Author)

Oregon U. Medical School, Portland.
TISSUE GLYCOGEN SYNTHESIS IN ADRENALECTOMIZED RATS FED GLYCINE-CONTAINING DIETS AND GIVEN HYDROCORTISONE, by W. R. Todd and Marilouise Allen. May 60, 7p. 8 refs. AAL Technical rept. 58-23.
Order from LC mi$1.80, ph$1.80 PB 147 744

Adrenalectomized rats were fed diets with or without added glycine for 36 hours. Four hours later they were made to swim in 14°C. water (the stress). Liver and muscle glycogen determinations at this time showed the levels to be essentially the same in the two groups of rats. When 1 mg. of hydrocortisone per 100 gm. body weight was given twice a day for 2 days prior to the stress, the glycine-fed animals showed nearly twice as much liver glycogen as the animals prefed the control diet. Muscle glycogen concentrations were not different. Adrenal hormone, glycine, and stress are required to demonstrate the "protein effect" of glycine. It now appears, however, that increased adrenal hormone is not a prerequisite. (Author)

Pennsylvania U. School of Medicine, Philadelphia.
METABOLIC AND THERMAL RESPONSE TO CHRONIC MODERATE COLD EXPOSURE, by H. T. Hammel. June 60, 47p. 14 refs. AAL Technical rept. 57-51.
Order from LC mi$3.30, ph$7.80 PB 150 568

Measurements of the thermal and metabolic responses of the Australian Aborigines exposed to moderate cold

stress have shown that there exists a small but important difference between these subjects and white controls. During an exposure to cold while sleeping at night, whites increased their heat production by 25% to 30% (averaged over the period of shivering) by shivering in bursts, whereas the metabolism of the natives declined continually throughout the night giving a Q_{10} of 2.5. Without metabolic compensation, the mean body temperature of the native fell continually during the night to a temperature 1° C. lower than the whites. The mean body temperature of the natives fell more than that of the whites because both the rectal and the average skin temperatures fell more. During the fall, cold acclimatization was induced in eight Norwegian young men by hiking and sleeping in the mountains, with light summer clothing during the day and a single blanket with wind cover during the night, air temperature near freezing. Measurements of the thermal and metabolic responses of the acclimatized subjects and controls, while sleeping during moderate cold exposure, revealed that the acclimatized subjects maintained a higher metabolic rate than did the controls. Because of the higher metabolic rate of the acclimatized group, the skin temperatures of these men were maintained higher than the skin temperatures of the controls. The rectal temperatures of the controls and acclimatized men were not different.

Pennsylvania U. School of Medicine, Philadelphia.
THERMAL AND METABOLIC RESPONSES OF THE AUSTRALIAN ABORIGINE IN SUMMER WHILE EXPOSED TO MODERATE COLD DURING SLEEP, by H. T. Hammel. July 60, 41p. 19 refs. AAL Technical rept. 58-21.
Order from LC mi$3.30, ph$7.80 PB 150 572

Measurements of the thermal and metabolic responses of the central Australian Aborigines exposed to moderate cold during sleep were repeated during the summer, and have shown that the small but important differences between the central natives and control whites exist in the summer to the same extent as in the winter.
(See also PB 150 568)

University Hospitals, Iowa City, Iowa.
DIMENSIONAL ANALYSIS OF COCHLEAR MODELS, by Juergen Tonndorf. Apr 60, 9p. 16 refs. AFSAM rept. 60-42; AD-238 114.
Order from LC mi$1.80, ph$1.80 PB 152 118

An attempt was made to apply the principles of dimensional analysis to cochlear models. Dimensional analysis of displacement amplitudes in the model involves: (1) correction for the ratio of ic differences; and (2) correction for frequency differences. Data were obtained which lend support to the hypothesis of the hydrodynamic origin of intracochlear distortion.

University of Southern California. School of Medicine, Los Angeles.
THE EFFECT OF INSULIN ON THE THYROID GLAND AND ITS INFLUENCE ON HEAT REGULATION, by Boris Catz, Ernest Geiger, and Heriberto Thomas. May 60, 12p. 20 refs. AAL Technical rept. 57-47.
Order from LC mi$2.40, ph$3.30 PB 150 219

Wistar strain rats, male adults, weighing from 90 to 125 grams, received 0.5 units of regular insulin twice a day for 8 days while at normal temperature (24°-26°C.), or in the cold room (3°C.). In ad libitum feeding at normal temperature, the insulin-treated animals gained significantly more weight than did the controls, and revealed a significant hyperplasia of the thyroid gland. Probably due to increased food intake, the cold-exposed animals receiving insulin did not show the initial loss of weight usually observed after exposure to cold. Their thyroid glands were less hyperplastic than those of the controls. In paired feeding experiments, the weight curve of the cold-exposed insulin animals was similar to that of the cold controls. The thyroids of the insulin-treated, cold animals, however, in spite of restricted food intake, were less hyperplastic than those of the pair-fed control rats. (Author)

University of Southern California. School of Medicine, Los Angeles.
A STUDY OF THE CARDIOVASCULAR ADJUSTMENTS TO THE INCREASED STRESS PRODUCED BY NARROWING OF THE ABDOMINAL AORTA, by Douglas R. Drury. June 60, 23p. 4 refs. AAL Technical rept. 57-33.
Order from LC mi$2.70, ph$4.80 PB 150 563

A study was made of the cardiovascular adjustments that occur in rabbits after narrowing the aorta just below the coeliac axis. The relationship between size of orifice, and (1) survival time, (2) development of hypertension, and (3) cardiac hypertrophy were determined. An orifice of diameter 1.65 mm. causes hypertension and congestive failure in 2 to 3 weeks in most animals. A diameter of 2.0 mm. leads to hypertension with cardiac hypertrophy. The performance of the hearts of these animals was measured by determining the maximum pressure they could sustain. The hearts from the experimental animals had increased performance and this was related to the cardiac hypertrophy. The peak performance was not changed by cooling the heart. Cardiac arrhythmias were frequent in the hypertrophied hearts. (Author).

Wisconsin U. School of Medicine, Madison.
COMPARATIVE EFFECTS ON ANESTHETIC AGENTS ON CARDIAC IRRITABILITY DURING HYPOTHERMIA, by John E. Steinhaus, Karl L. Siebecker, and James R. Kimmey. May 60, 15p. 8 refs. AAL Technical rept. 58-24.
Order from LC mi$2.40, ph$3.30 PB 150 215

The effect of four anesthetic agents administered singly or in combination on the incidence of ventricular fibrillation in dogs during hypothermia was investigated. Arrhythmias were initiated with the application of mechanical stimulation in the form of cardiac massage. At 27° C. there were no instances of fibrillation despite periods of high pCO_2 and hypoxia. At lower temperatures cyclopropane anesthesia resulted in the highest incidence of this serious arrhythmia. Thiopental-nitrous oxide anesthesia supplemented with lidocaine markedly reduced the occurrence of this arrythmia; however, cardiac failure occurred frequently. At a temperature of 22-23° C. failure was markedly reduced when lidocaine was used as a supplement. (Author)

Biochemistry

Arctic Aeromedical Lab., Ladd AFB, Alaska.
BLOOD CHEMISTRY OF THE COLD ACCLIMATIZED RAT. II. GROSS METABOLITE AND PHYSICAL CHANGES, by John P. Hannon and David W. Young. Apr 60, 33p. 32 refs. Technical rept. 60-16.
Order from LC mi$3.00, ph$6.30 PB 150 578

The gross blood composition of adult, male, Sprague-Dawley rats was determined under control conditions and conditions of prolonged cold exposure. In addition, the effects of fasting were determined under each of these environments. It was observed that cold exposure induced a slight, but significant, increase in hemoglobin levels, but had no effect on the hematocrit. Fasting, on the other hand, did not alter the hemoglobin concentrations of either the control or the cold-exposed animals, but it did produce a slight lowering of the hematocrit. Cold exposure also resulted in a plasma dilution as indicated by a significant increase in plasma water, and significant decreases in plasma specific gravity and plasma protein levels. Fasting was observed to superimpose a further reduction in plasma protein levels under both control and cold-exposed conditions. Measurements of the levels of various metabolites indicated that the levels of blood glucose and total plasma lipids were unaltered by cold exposure but that each was significantly reduced by fasting. On the other hand, it was observed that cold exposure led to significant increases in the non-protein nitrogen, phospholipid, cholesterol, and ketone levels of non-fasted animals. Superimposed on these changes, fasting produced a decrease in the levels of non-protein nitrogen and phospholipids and an increase in the level of ketones, but it had no effect on the level of cholesterol. Significant differential effects of fasting on the two environmental groups were found for non-protein nitrogen, phospholipid, and ketones. Thus, fasting in the cold-exposed animals caused greater reductions of non-protein nitrogen and phospholipids and a smaller increase in blood ketones as compared to controls. (Author) (See also PB 150 577)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE EFFECT OF COLD ON THE WEIGHT, FOOD INTAKE, AND ACETYLATING ACTIVITY OF PANTOTHENIC ACID-DEFICIENT RATS, by David A. Vaughan and Lucile N. Vaughan. Apr 60, 15p. 11 refs. AAL Technical rept. 59-23.
Order from LC mi$2.40, ph$3.30 PB 147 745

Growth, food intake, and acetylating activity were measured in rats kept at 5° C. and 25° C. while receiving a pantothenic acid-deficient diet supplemented with 0.5, 1.5, and 5.0 μg calcium pantothenate per gram of food. Respective mean weight changes at these levels of calcium pantothenate were +13, +30, and +100 gm. for the warm rats and +2, +14, and +83 gm. for the cold rats. Food intake increased as the level of calcium pantothenate increased, but the difference in food intake between the warm and cold rats remained constant at all levels of calcium pantothenate. Acetylating activity was not affected by exposure to cold, although it decreased with decreasing dietary levels of calcium pantothenate. (Author).

Arctic Aeromedical Lab., Ladd AFB, Alaska.
INTERMEDIARY GLUCOSE METABOLISM IN THE COLD ACCLIMATIZED RAT, by John P. Hannon. Apr 60, 28p. 30 refs. Technical rept. 60-15.
Order from LC mi$2.70, ph$4.80 PB 150 213

The effects of 3-4 weeks' cold exposure (5 1°C.) on the activities of glucokinase, glucose-6-phosphatase, glucose-6-phosphate and 6-phosphogluconic dehydrogenases, total phosphorylase, phosphorylase a and b, phosphoglucomutase and pyruvate formation over the terminal glycolytic span of enzymes were assayed. Various shifts in the pattern of intermediary hexose metabolism as a result of cold exposure are discussed. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
TISSUE ENERGY METABOLISM IN THE COLD ACCLIMATIZED RAT, by John P. Hannon. Apr 60, 33p. 33 refs. Technical rept. 60-14.
Order from LC mi$3.00, ph$6.30 PB 150 577

Data are given relating the effect of duration of cold exposure on liver slice and whole body oxygen comsumption of laboratory rats. Data are also presented on the effect of cold exposure on various liver oxidase activities, oxidative phosphorylation and adenosinetriphosphatase activities. The comparative study of electron transport components in liver and muscle is given. These data are discussed in relation to the development of nonshivering thermogenesis and the cellular metabolic control mechanisms in the cold acclimatized animal. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
IMMUNOCHEMICAL STUDIES ON MITOCHROME, by E. R. Stiehm. Rept. no. 10 on Proj. MR005.15-0002.7; Proj. TED ADC RS-7045-5915M. 11 Aug 60, 19p. 7 refs. NADC-MA-6020.
Order from LC mi$2.40, ph$3.30 PB 150 441

A precipitating antibody to rat liver mitochrome was prepared by immunizing rabbits using the Freund adjuvant technique. This antibody was characterized by quantitative precipitin techniques and was found to be directed against a small portion of the mitochrome. Albumin and cytochrome c, which have been shown to interact with mitochrome, do not inhibit its immunologic activity, demonstrating that the metabolic and the immunologic sites of mitochrome are distinct. The antibody has the ability to decrease cytochrome oxidase activity of whole mitochondria, but has no effect on the activity of purified cytochrome oxidase, suggesting the non-identity of mitochrome and inactive cytochrome oxidase, contrary to a recent report. (Author)

Illinois U. Coll. of Medicine, Chicago.
THE EFFECT OF ENVIRONMENTAL FACTORS ON THE METABOLISM OF PLASMA PROTEINS. I. THE MEASUREMENT OF TURNOVER RATE, by Richard J. Winzler. June 60, 18p. 14 refs. AAL Technical rept. 57-35.
Order from LC mi$2.40, ph$3.30 PB 150 565

The turnover rates of the electrophoretic plasma protein fractions were determined for normal adult rats. When the isotopically labeled plasma protein was used as a source of tracer labeling, accurate measurements of the pool size, half-life, and replacement rate of albumin and gamma globulin were possible. Certain technical difficulties are still present in the turnover rate determination of the alpha and beta globulins. It was also shown that the label of the albumin was incorporated into the various globulins, and that the label of a globulin was incorporated into albumin. (Author)

Illinois U. Coll. of Medicine, Chicago.
THE EFFECT OF ENVIRONMENTAL FACTORS ON THE METABOLISM OF PLASMA PROTEINS. II. THE EFFECT OF THE LEVEL OF DIETARY PROTEIN ON THE TURNOVER RATE OF SERUM PROTEINS, by Richard J. Winzler. June 60, 19p. 27 refs. AAL Technical rept. 57-54.
Order from LC mi$2.40, ph$3.30 PB 150 570

The turnover rates of serum albumin and the four electrophoretic fractions of serum globulins were determined in rats maintained on low (0-5%), adequate (12%), and high (30-40%) protein diets. It was found that the turnover rate of serum albumin increased as the protein intake increased, i.e. 4.1 days, 3.8 days, and 2.1 days for animals on low, adequate, and high protein diets, respectively. The turnover rates of the four electrophoretic fractions of serum globulins were unaffected by the level of dietary protein. Furthermore, the protein pool size was found to be dependent upon the size of the animal rather than upon the protein intake. (Author) (See also PB 150 565)

Oregon U. Medical School, Portland.
MAINTENANCE OF CARBOHYDRATE STORES DURING STRESS OF COLD AND FATIGUE IN RATS PREFED DIETS CONTAINING ADDED GLYCINE, by W. R. Todd and Marilouise Allen. June 60, 18p. 8 refs. AAL Technical rept. 57-34.
Order from LC mi$2.40, ph$3.30 PB 150 564

Previous data indicated that rats prefed a diet containing 10 percent added glycine showed higher levels of glycogen storage during the stress of fasting or of administered insulin than did animals fed the same diet but without added glycine. The present report indicates that the glycine feeding allows increased carbohydrate storage during the stress of cold (8°C. in cold room) and of cold plus fatigue (swimming in 14°C. water). The trichloracetic acid-soluble fraction of liver glycogen is quite labile toward the stress of swimming, and leaves the liver to a greater extent under the stress of insulin. Glycine feeding tended to lessen the loss of the soluble fraction under the latter stress. The data are taken as additional support for an earlier postulate that glycine prefeeding stimulates glycogenesis during stress—probably mediated through adrenal cortical action. (Author)

St. Luke's Hospital, New York.
PROTEIN AND AMINO ACID NUTRITION, by Anthony A. Albanese (St. Luke's Convalescent Hospital). Annual progress rept. for 1 Jan-31 Dec 59 on Contract Nonr-1167(00). 15 Nov 59, 15p. 10 refs. AD-229 379.
Order from LC mi$2.40, ph$3.30 PB 150 471

Contents:
Protein needs of young children
Specific amino acid needs of infants
  Cereal food studies
  White bread studies
Specific amino acid needs of the aged
Nutritional effects of hormones
  Anabolic steroids
  Corticoids
Factors influencing blood cholesterol
Investigations on body composition
Biochemical methods
Organizational activities

Tufts U. School of Medicine, Boston, Mass.
LIPOGENESIS FROM CARBOHYDRATE IN THE NEGATIVE CALORIC BALANCE STATE INDUCED BY EXPOSURE TO COLD. I. GLUCOSE LIPOGENESIS IN RATS IN NEGATIVE CALORIC BALANCE, by E. J. Masoro, Carmen L. Asuncion and others. Apr 60, 10p. 9 refs. AAL Technical rept. 57-31.
Order from LC mi$1.80, ph$1.80 PB 147 743

The ability of rats exposed to 0-2° C. for 1 or 2 days to incorporate dietary glucose isotopic carbon into fatty acids was studied. Under these circumstances, in spite of a large intake of food, there is a loss in body weight and fatty acids. Whether calculated on a percentage or on an absolute basis, there is under the conditions a considerable incorporation of the label into fatty acids. It is concluded that not only in the steady state, but also in a state of negative caloric balance, lipogenesis is one of the obligatory pathways of carbohydrate metabolism. (Author).

University of Southern California. School of Medicine, Los Angeles.
THE NITROGEN CONTENT OF THE GASTROINTESTINAL TRACTS OF RATS DURING THE ABSORPTIVE PERIOD, by E. Geiger, L. E. Human, and M. J. Middleton. June 60, 9p. 8 refs. AAL Technical rept. 57-48.
Order from LC mi$1.80, ph$1.80 PB 150 567

By feeding rats protein-free test meals and determining the nitrogen levels in the gastrointestinal contents, it has been found that the basal level of endogenously supplied nitrogen is about 5 mg. after 1 1/2 hours, and that this level is unaffected by protein depletion. On feeding skim milk powder, 22-27% of the ingested protein disappears from the gastrointestinal tract within 3 hours. Under the conditions of these experiments, any homeostatic action of the gut in supplementing amino acids to deficient protein meals is negligible. (Author).

Washington U., Seattle. School of Medicine.
THE CHANGES IN THE RED CELL AND PLASMA VOLUMES OF THE RAT AND OF ITS INDIVIDUAL TISSUES AND ORGANS DURING ACCLIMATION TO COLD, by Newton B. Everett. Rept. on Contract AF 41(657)104. June 60, 13p. 12 refs. AAL Technical rept. 58-18.
Order from LC mi$2.40, ph$3.30 PB 150 230

The red cell and plasma volumes of the total rat and of its individual tissues and organs have been determined for animals exposed to 5°C. for 4 hours, 24 hours, and 2 weeks. In addition, the tissue hematocrits have been determined. These values have been compared to those of rats kept at 24°C. Fe^{59}-labeled erythrocytes and I^{131} albumin were given intravenously and after mixing; the rats were frozen in liquid nitrogen. The organs and tissues were removed in the frozen state, assayed for radioactivity, and blood cell and plasma volumes were calculated on a unit weight basis. Significant changes in blood cell and plasma volumes were observed for the total rat and for most of the individual organs. The total body blood volume increased 18% in the 2-week group. In general, the somatic parts had increased blood volumes whereas the visceral parts had decreased volumes. (Author)

Pathology

Arctic Aeromedical Lab., Ladd AFB, Alaska.
CLINICAL EXPERIENCES IN TREATMENT AND REHABILITATION OF FROSTBITE IN ALASKA, by William J. Mills, Jack D. Douglas and others. Apr 60, 10p. 4 refs. Technical rept. 59-24.
Order from LC mi$1.80, ph$1.80 PB 147 746

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE EFFECT OF A RIBOFLAVIN DEFICIENCY ON COLD-ADAPTED RATS, by David A. Vaughan and Lucile N. Vaughan. June 60, 13p. 11 refs. Technical rept. 59-8.
Order from LC mi$2.40, ph$3.30 PB 150 576

Fifty riboflavin-deficient adult rats (175-250 gm.) were divided into two groups. Twenty-five were subjected to moderately severe cold (5° C.); 25 were maintained at 25° C. Each group was divided into five subgroups, which received a riboflavin-deficient diet for 28 days, supplemented with the following levels of riboflavin: 0.5 µg./gm. diet, 1.0 µg./gm., 1.5 µg./gm., 2.0 µg./gm., and 4.0 ug./gm. Respective mean weight changes at these levels of riboflavin intake were: -4gm., +31gm., +63gm., +77 gm., and +63 gm. for the cold rats; -6 gm., +34 gm., +73 gm., +88 gm., and +100 gm. for the warm rats. A statistical analysis indicated that there was no significant difference in weight response between the warm and cold rats at deficient levels of riboflavin intake. Data obtained on the food intake of these animals suggest that the growth response to various levels of riboflavin is a function of both appetite and efficiency of food utilization. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE EVALUATION OF THE USE OF ULTRASOUND FROSTBITE THERAPY, by Jack D. Douglas. Aug 60, 10p. 5 refs. Technical note AAL-TN-60-11.
Order from LC mi$1.80, ph$1.80 PB 152 032

The use of ultrasound as an adjunct to 42°C water in immediate, rapid rewarming of frostbitten tissues was evaluated. Results of these studies using rabbits did not indicate that any benefit was produced. However, it is felt that further studies should be accomplished with larger animals before a final verdict is rendered regarding the value of ultrasound in frostbite therapy. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
FLUORIDE CONTENT OF ALASKAN ESKIMO TOOTH SAMPLES, by Gisle Bang. May 60, 14p. 21 refs. Technical rept. 59-7.
Order from LC mi$2.40, ph$3.30 PB 150 229

The chemical analyses of the tooth samples from ancient Point Hope Eskimo skulls revealed much higher average values for the fluoride content in the enamel and dentin than would be expected, considering the probable low fluoride content of the drinking water in the area. The average fluoride concentrations in enamel and dentin of teeth from contemporary Alaskan Eskimos were comparable with values from other communities with similar low contents of fluorides in the water supplies. The fluoride analyses of teeth from contemporary Eskimos revealed no significant differences between samples from persons with and without caries or between anterior and posterior teeth. (See also PB 144 833).

Arctic Aeromedical Lab., Ladd AFB, Alaska.
INCIDENCE OF UPPER RESPIRATORY DISEASE AMONG MILITARY POPULATIONS IN ALASKA, by E. Lee Treece (U. of Kansas) and Jerome P. Schmidt. Aug 60, 48p. 30 refs. AAL Technical rept. 57-44.
Order from LC mi$3.30, ph$7.80 PB 150 566

The incidence of upper respiratory disease in military populations at Ladd Air Force Base was studied and the ability of an experimental influenza-adenovirus vaccine to reduce the incidence of upper respiratory infections was evaluated during the winter of 1956-57. The incidence of bacterial and viral pathogens found in association with clinically recognized infections was low. Of seven types of bacterial pathogens isolated, beta hemolytic streptococci was encountered most frequently. Serological analysis revealed the presence of both influenza virus and adenoviruses. Influenza virus, type A, was the most frequently occurring virus. Military populations vaccinated with influenza and/or adenovirus vaccine experienced a lower incidence of infection than did control groups. The duty time lost by vaccinated groups was significantly less than the duty time lost by control groups. Military personnel were not considered to be predisposed to respiratory infection by factors peculiar to the Arctic and associated with environmental weather, protective clothing, type of duty assignment, or living quarters. The problem of upper respiratory disease in Alaska does not appear to offer any unique features which would differentiate it from the same disease occurring elsewhere in the world. (Author).

Arctic Aeromedical Lab., Ladd AFB, Alaska.
A REPORT OF 103 AUTOPSIES ON ALASKAN NATIVES, by Arthur W. Gottmann. June 60, 23p. 16 refs. Technical rept. 59-6.
Order from LC mi$2.70, ph$4.80 PB 150 214

Qualitatively, the pathological findings within the native Alaskan population do not appear to be significantly different from those found in the rest of the United States. The problem of infectious disease, as might be expected, is greater in this group where insufficient medical facilities and weather combine to make adequate medical care difficult. The opportunities for clinical studies of these relatively isolated people, and some of the specific questions which remain unanswered, are included in the discussion. (Author)

Army Chemical Research and Development Labs., Army Chemical Center, Md.
THE CULTURE OF CELLS FROM KIDNEY TISSUE WOUNDED BY HIGH-VELOCITY MISSILES, by Margaret W. Cavanaugh. Rept. for Nov 58-Oct 59 on Wound Ballistics. July 60, 26p. 15 refs. Technical rept. CRDLR 3016.
Order from LC mi$2.70, ph$4.80 PB 152 003

Adult Angora goat kidney was shot with high-velocity bullets and fragments of cortical tissue from the margin of the permanent wound tract were cultured in nutrient medium to test whether any viable cells survived the trauma caused by the formation of the temporary cavity. (Author)

Biomedical Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
A NEW CHRONIC POLAROGRAPHIC IMPLANT UNIT FOR MEASUREMENT OF CEREBRAL OXYGEN AVAILABILITY, by Lawrence R. Parton, Jay M. Lauer, and Douglas L. Smith. Rept. for Dec 58-Aug 59 on Health Hazards of Materials and Radiation. May 60, 12p. 5 refs. WADD Technical rept. 60-388.
Order from OTS $0.50 PB 171 073

This report describes the design and development of a chronic brain polarographic implant unit capable of detecting small changes in cerebral oxygen availability (aO_2). The design and fabrication of this unit: (a) provide for integral construction of both an anode and a cathode in a single assembly (the brain probe, cathode, may be changed or replaced without removal of the basic polarographic unit) and (b) improve surgical implant methods resulting in a simple, rapid, and relatively bloodless operation. Reproducible data can be obtained within 5 days (often as soon as 2 days) following postsurgical recovery. (Author)

Brooklyn Coll., N. Y.
INCIDENCE OF ANIMAL PARASITES IN THE RESIDENTS OF THE EAST YUKON FLATS, ALASKA, by George S. Tulloch. June 60, 40p. 16 refs. AAL Technical rept. 57-19.
Order from LC mi$3.00, ph$6.30 PB 150 561

A sampling was made of the human population in seven of the villages of the East Yukon Flats of Alaska to determine the incidence of animal parasites to provide a basis for appraising their potential dangers to military personnel operating in this area. Fifty-six or 22% of 25[illegible] residents were reactors to Trichinella spiralis antigen given intradermally. Seventy-four or 32% of 228 persons harbored intestinal protozoa. Diagnosis of the pathogen, Endamoeba histolytica, was established in one case and eight others were considered suspicious. Giardia lamblia, a form of questionable pathogenicity, was recovered from 16 individuals. Sixty-one or 31% of 198 persons, mostly in the age range of 1-10, were positive for pinworm ova. Mites of the family Eupodidae (Eupodes sp.) were recovered on the pinworm swabs of four children at Stevens Village. This is believed to be the first record of an arachnid utilizing the perianal region of man as a site for a fixed association. Fifteen or 21% of 70 persons were reactors to an experimental antigen employed in testing for the presence of the larval stages of Echinococcus granulosis.

Buffalo U. School of Medicine, N. Y.
PULMONARY EDEMA, EXPIRED AIR RESUSCITATION, AND THE CHEMICAL CONTROL OF RESPIRATION, by David G. Greene. Final rept. for 1 Sep 50-31 Aug 59 on Contract DA 49-007-MD-209. 8 refs. AD-229 644.
Order from LC mi$1.80, ph$1.80 PB 150 788

Pulmonary edema due to increased capillary permeability has been produced with alpha-naphthyl thiourea, and pulmonary edema due to increased pulmonary venous pressure has been produced with saline and norepinephrine. Both types are better treated with intermittent positive pressure than with a resuscitator with a negative phase in the pressure cycle. Pulmonary compliance is reduced in both types in animals, and in patients with pulmonary edema, in whom it is a quantitative expression of the degree of pulmonary edema. Expired air resuscitation has been established on firm physiological principles and applied to the integrated plan for the ventilatory management of the nerve gas casualty in the field, during transport, and in rear installations. The best techniques for general use and teaching have been developed, and several training-aids worked out. The chemical control of respiration in man has been studied with trishydroxymethylaminomethane, which has been given intravenously to volunteers while various parameters have been measured, including ventilation, alveolar and arterial CO_2 tension, arterial oxygen saturation and pH, urine flow, et al. The data suggest a feedback mechanism based on CO_2 tension. (Author)

Kansas U. [Lawrence]
THE ROLE OF MAST CELLS AND HEPARIN IN CERTAIN PATHOLOGICAL PROCESSES, by Tom R. Hamilton. Final technical rept. for 1 Apr 53-31 Mar 58 on Contract Nonr-583(05). Nov 59, 6p. 12 refs.
Order from LC mi$1.80, ph$1.80 PB 150 856

The object of this project is to study the role of heparin and related polysaccharides in proliferative reactions of mesenchymal tissues with special emphasis upon skin, cardiac and synovial tissues as applied to fundamental changes in keloid formation and rheumatic diseases respectively; and to determine how components and products of mesenchymal tissue are involved in streptococcic infectios and in the pathogenesis of abnormal responses related to proliferative disease.

North Carolina State Coll., Raleigh
FURTHER STUDY OF ALASKAN SCHISTOSOMES, by Reinard Harkema and David A. Becker. June 60, 25p. 12 refs. AAL Technical rept. 57-16.
Order from LC mi$2.70, ph$4.80 PB 150 560

Cercariae obtained from naturally infected snails, Lymnaea stagnalis, were used in experimental infections of ducklings. The adult form is described and named Trichobilharzia alaskensis Harkema, McKeever, and Becker. The miracidium of this species is described and limited studies on the sporocyst stages are presented. Developing metacercariae were found in the lungs of ducklings 2 days after exposure. Three new sources of itch-producing schistosome cercariae were found: Birch Lake, Smith Lake, and Chena Slough (Badger Road). Metacercariae were recovered from hemorrhagic lesions in the lungs of hamsters 1, 2 and 3 days after exposure to cercariae. (Author).

Oklahoma U. Research Inst., Norman.
EPIDEMIOLOGY OF TULAREMIA IN ALASKA, by Cluff E. Hopla. June 60, 44p. 45 refs. AAL Technical rept. 59-1.
Order from LC mi$3.30, ph$7.80 PB 150 574

Skin test results indicate that tularemia is widespread throughout central Alaska. The high number of positive skin tests and serologies in certain villages below the Arctic Circle implies that the disease, when it does occur, must be one of relatively low virulence. Studies among the Indians of Canada showed that it is often mistaken for tuberculosis. As of now, the varying hare has not been found naturally infected with Bact. tularense in Alaska. To date, the most important role that can be ascribed to this hare is that of being the principal host of the rabbit tick. The spleens from various terrestrial rodents, totaling slightly over 1,500 specimens, were not found infected with tularemia organisms. All of the positive isolations of Bact. tularense in Alaska have come from the rabbit tick, Haemaphysalis leporis-palustris. This tick is of indirect importance to man inasmuch as it seldom, if ever, attempts to obtain a blood meal from him. However, various authorities believe that this tick is the most important reservoir of tularemia in the wild. The possible role of blood-sucking Diptera is discussed. The possible relationship of the muskrat-beaver, water and mud association, is reviewed.

School of Aviation Medicine, Brooks AFB, Tex.
RAPID DECOMPRESSION: A PROTECTIVE SUBSTANCE, by William G. Malette, John B. Fitzgerald, and Ben Eiseman (Denver Veterans Administration Hospital). June 60, 4p. 13 refs. Rept. 60-62.
Order from LC mi$1.80, ph$1.80 PB 149 246

Rats injected with saline and methylsiloxane were exposed to a large dose of gas emboli by means of rapid decompression. There was a significant reduction in mortality rate in the methylsiloxane-treated group. The possible mechanisms for such protection may be the lowering of interfacial tension or the prevention of surface films. (Author).

School of Aviation Medicine, Brooks AFB, Tex.
A RAPID DECOMPRESSION CHAMBER FOR SMALL ANIMALS, by William G. Malette, John B. Fitzgerald, and Ben Eiseman (Denver Veterans Administration Hospital). Aug 60, 5p. Rept. 60-73.
Order from LC mi$1.80, ph$1.80 PB 150 207

Pharmacology and Toxicology

Army Chemical Research and Development Labs., Army Chemical Center, Md.
THE INHALATION TOXICITY OF PERCHLORYL FLUORIDE, by Earle A. Greene, Joseph L. Colbourn and others. July 60, 23p. 27 refs. CRDLR-3010.
Order from LC mi$2.70, ph$4.80 PB 150 665

The object of this investigation was to study the toxic effects of single 4-hour and repeated (6 hours per day, 5 days per week) exposures to perchloryl fluoride gas on rodents and dogs. Single exposures of rodents and dogs to concentrations ranging from 220 ppm to 885 ppm and repeated exposures of rodents to 185 ppm for 7 weeks caused pulmonary irritation, methemoglobinemia, and blood destruction. Urinary excretion and bone deposition of fluoride occurred in rodents exposed to 185 ppm and in rodents and dogs exposed repeatedly to 24 ppm of perchloryl fluoride for 26 weeks. (Author) (See also PB 139 881)

Massachusetts Inst. of Tech., Cambridge.
SYNTHESIS OF SCOPOLAMINE AND RELATED COMPOUNDS. THE TOTAL SYNTHESIS OF SCOPOLINE AND trans-6,7-DIHYDROXYTROPINE, by John C. Sheehan, Arnold Vogel, and Ding-Djung H. Yang. Final rept. for 15 Oct 52-14 Apr 56, Contract N5ori-07877. [1959] 8p. 10 refs.
Order from LC mi$1.80, ph$1.80 PB 152 096

Scopoline (oscine), a rearrangement product derived from scopolamine by acidic or basic hydrolysis, has been synthesized totally via trans-6,7-dihydroxytropine. Alkaline hydrolysis of 2,3-epoxy-2,5-dimethoxytetrahydrofuran (derived from furan) produced trans-3,4-dihydroxy-2,5-dimethoxytetrahydrofuran, which was hydrolyzed to DL-tartaraldehyde. A Robinson synthesis with methylamine and acetonedicarboxylic acid afforded trans-6,7-dihydroxytropinone. Catalytic reduction gave trans-6,7-dihydroxytropine, which cyclized to scopoline on successive treatment with hydrogen bromide and dilute hydrochloric acid.

Michigan U., Ann Arbor.
ORGANO-TIN TOXICOLOGY, by T. M. Brody. Progress rept. 1 May-30 Nov 59, on Contract Nonr-1224(27). 30 Nov 59, 5p. AD-229 833.
Order from LC mi$1.80, ph$1.80 PB 150 488

Various tissues were analysed for content of triethyl tin acetate (TET) after administration with the view of correlating in vivo concentration with that required to produce a biochemical change in vitro. A method was used which is a modification from Cremer (Biochem. J. 67:87, 1957). In order to determine if the uncoupling action of TET seen in in vitro systems might be responsible for the actions of this compound in the whole animal, homogenates and mitochondria were prepared from brains and livers of rats previously treated with TET. Despite the uncoupling potency of TET in vitro no effect was shown in vivo on oxidative phosphorylation of rat brain and liver mitochondria and homogenates. The failure to see any effect here may be the result of excessive dilution of TET during the preparation of the various tissues for assay. In an

attempt to determine whether the uncoupling action of TET was similar in mechanism to that of 2, 4-dinitrophenol, TET was compared with DNP on the acceptor-deficient system and on ATP-ase activation. In contrast to the work of Cremer and Aldridge, TET did not accelerate respiration in an acceptor-deficient system. Endogenous ATP-ase activity as well as magnesium-activated and DNP-activated ATP-ase were studied. There appeared to be no stimulation of ATP-ase activity by TET; rather this compound inhibited both the DNP and magnesium ATP-ases

Minnesota U. School of Veterinary Medicine, St. Paul.
STUDIES OF SKIN, BLOOD, AND RECTAL TEMPERATURES OF UNANESTHETIZED DOGS EXPOSED TO EXTREME COLD. II. EFFECTS OF CARBON DIOXIDE, EPINEPHRINE AND ILIDAR, by A. L. Good and A. F. Sellers. July 60, 17p. 22 refs. AAL Technical rept. 57-53.
Order from LC mi$2.40, ph$3.30 PB 150 569

Polyethylene cannulae were surgically placed in the pulmonary artery and in the posterior vena cava at a point where the hepatic veins enter (referred to as "hepatic vein"). Thermistors mounted in polyethylene tubing were passed through these cannulae and the temperature changes of blood, skin (thorax, forearm, paw), and rectum were recorded photographically. The effects of carbon dioxide, epinephrine, and Ilidar were superimposed on extreme cold while continuously recording blood, rectal, and skin temperatures. Carbon dioxide inhalation was associated with a fall in blood and rectal temperatures and marked diminution of shivering. Little effect on skin temperatures was noted. It was thought that the decrease in metabolism contributed to the fall in "core" temperature. Epinephrine, given intravenously in doses of 2.5 mg. /kg. was associated with an immediate cessation in shivering which persisted for 1 to 2 minutes. Blood and rectal temperatures fell slightly; skin temperature showed little change. The intravenous administration of Ilidar in doses of 4.0 mg. /kg. was associated with rather marked rises in blood and rectal temperature which were additive to those resulting from exposure to cold. Skin temperatures were only slightly affected. Apparently the doses of Ilidar were too small to block cutaneous vasoconstriction induced by sympathetic impulses reaching the cutaneous vessels. Vasodilation in the viscera could result in shunting blood away from the skin and in this way increase internal temperatures (Author)

Radiobiology

Baylor U. Coll. of Medicine, Houston, Tex.
A STUDY OF THE EFFECTS OF TOTAL AND PARTIAL BODY RADIATION ON IRON METABOLISM AND HEMATOPOIESIS, by Vincent P. Collins, C. T. Teng, and Walton D. West. Rept. for 1 Dec 58-31 Aug 59, on Contract DA 49-007-md-428. [1959] 21p. AD-228 105.
Order from LC mi$2.70, ph$4.80 PB 152 640

This report released for sale to the public 7 Nov 60.

(1) Response of hematopoietic system following fractionated doses of total body radiation is reported in two patients; (2) Radiation effect on absorptive function of intestinal mucosa has been studied by measuring absorption of radioiodine labeled serum albumin before and after limited field or total body radiation; and (3) The clinical and hematopoietic response following total body radiation with shielding of critical areas has been studied in a pilot experiment using laboratory animals. The physical condition of the irradiated animals, state of nutrition, and latent infection must be taken into account by carefully preparing animals to minimize the influence of these factors. (Author)

Food and Drug Research Labs., Inc., New York.
THE EFFECT OF IRRADIATED FOODS ON SPECIFIC ENZYME LEVELS IN BLOOD, by Alvin S. Ostashever, Kenneth Morgareidge and others. Final rept. on Contract DA 49-007-MD-862. Sept. 59, 28p. 7 refs. AD-229 312.
Order from LC mi$2.70, ph$4.80 PB 150 671

A series of studies performed for the purpose of evaluating the possible effects of irradiated food on certain of the blood enzyme systems are reported. Control and irradiated pork, bread, green beans, and shrimp were fed to young rats for a period of approximately 12 wk. The test samples of pork, green beans, and shrimp were irradiated at both the 2.79 and 5.58 megarad levels while the bread was exposed to 25 and 50 kilorads. On a dry weight basis the pork was incorporated into the test diet at a 35% level, the bread at 80%, and the green beans and shrimp at both 35 and 80% levels. These foods were formulated into diets containing, in addition, adequate amounts of other essential nutrients (vitamins, minerals, and in some cases, casein as a supplementary protein). The blood enzyme systems assayed in the rats on these experimental diets were: (1) serum alanine-a-ketoglutarate transaminase: (2) erythrocyte transketolase: (3) erothrocyte glycolysis; (4) erythrocyte aerobic oxidation of glucose in the presence of methylene blue: (5) erythrocyte glutathione reductase. The results of these studies demonstrated that the rats fed diets containing these levels of highly irradiated foods displayed normal growth responses and normal activity of the 5 blood enzyme systems investigated. (Author)

Physics, Engineering, Chemistry Corp., Boulder, Colo.
BIOMEDICAL EFFECTS OF EXPOSURE TO ELECTROMAGNETIC RADIATION. PART I: ULTRAVIOLET, by Archibald R. Buchanan, Harold C. Heim, and Donald W. Stilson. Rept. on Physiology Research, Contract AF 33(616)6305. May 60, 187p. 657 refs. WADD Technical rept. 60-376.
Order from OTS $3.00 PB 171 072

Literature concerning the biomedical effects of ultraviolet radiation is reviewed. Ultraviolet absorption results in mitotic alterations and abnormal cell divisions, regressive changes in the somatic structures of some lower animals, and skin and eye tumors in mammals. Damage to the eye from high intensity ultraviolet is probably limited to the cornea and, to a slight extent, the lens. The effects elicited by ultraviolet irradiation of certain proteins, nucleotides, enzymes, hormones, and amino acids are reviewed. Literature pertinent to the visibility and hue of ultraviolet, the effects of

ultraviolet wavelengths on scotopic and photopic visual sensitivity and on the "reactivity" of the organism is surveyed. (Author)

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. VOLUME I, NO. 7. Quarterly rept. Oct 60, 68p. 6 refs.
Order from OTS $1.00,$9.00/yr. PB 161 371-7

Contents:
Sect. 1. Milk: Public Health Service milk monitoring program; data on radioactivity in milk at Honolulu, Hawaii (Jan-Mar 60)
Sect. 2. Air: Public Health Service radiation surveillance network; Public Health Service national air sampling network
Sect. 3. Water: Public Health Service national water quality network
Sect. 4. Other data: external gamma activity; daily intake of calcium and strontium-90 from environmental sources; concentration of strontium-90 in whole wheat and white bread purchased in New York City in 1958-1960; estimated daily per capita intake of wheat milling products and the relative contribution of strontium-90 from such products to the total diet; strontium-90 in milk and agricultural materials in the United Kingdom (1958-1959); estimate of strontium-90 in the diet of New York City infants nurtured on commercially processed baby foods and milk; food consumption of households in the United States, Southern and Western Regions (1955); the cesium-potassium trend in humans at Chicago as a function of time; Delaware River surveillance summary report; radioactive fallout from nuclear detonations of Feb and Apr 60; fallout studies. (See also PB 161 371-6)

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. VOLUME I, NO. 8. Monthly rept. Nov 60, 55p.
Order from OTS $1.00, $9.00/yr. PB 161 371-8

Contents:
Sect. 1. Milk: Public Health Service milk monitoring program; data on radioactivity in milk (Apr-June 60); secretion of dietary strontium-90 and calcium in human milk
Sect. 2. Air: Public Health Service radiation surveillance network; Public Health Service national air sampling network; U. S. Naval Research Laboratory radioactivity measurements (June 60)
Sect. 3. Water: Public Health Service national water quality network; monitoring water supplies around the Nevada Test Site (May-June 60)
Sect. 4. Other data: External gamma activity (June 60); summary of research results related to environmental radioactivity; environmental levels of radioactivity at Atomic Energy Commission installations; strontium-90 in wheat and wheat products; Montefiore Hospital metabolic studies; short term training in radiological health.
(See also PB 161 371-7)

Radiobiological Lab., U. of Texas, Austin.
A NEW CHRONIC LOW-DOSE COBALT-60 FACILITY OF THE RADIOBIOLOGICAL LABORATORY, by Hugh L. Perry. Jan 60, 6p. 2 refs. AFSAM rept. 60-22; AD-233 168.
Order from LC mi$1.80, ph$1.80 PB 152 353

This report released for sale to the public 28 Oct 60.

Design of this new chronic low-dose Cobalt-60 facility provides a safe, reliable operation meeting the requirements set forth by the Radiobiological laboratory. An acceptable range of flux variation throughout the cage was found. However, a rotation of animal placement in the cages and the randomized movements of the animals in the cages should minimize the difference of radiation dose delivered to each animal. (Author)

Zoology

University of Southern California, Los Angeles.
OBSERVATIONS ON THE REPRODUCTIVE CYCLE OF THE MALE ARCTIC GROUND SQUIRREL (SPERMOPHILUS UNDULATUS) by Ormond G. Mitchell June 60, 21p. 11 refs. AAL Technical rept. 57-26.
Order from LC mi$2.70, ph$4.80 PB 150 562

The study was undertaken in an effort to correlate the histological changes observed in the testes with the relatively short activity cycle.

Virginia U. School of Medicine, Charlottesville.
A STUDY OF GROSS BODY COMPOSITION OF SMALL ALASKAN MAMMALS AS COMPARED WITH THOSE FROM THE TEMPERATE ZONE, by Grover C. Pitts. June 60, 31p. 20 refs. AAL Technical rept. 59-3.
Order from LC mi$3.00, ph$6.30 PB 150 575

Gross composition of the body with respect to fat, water, specific gravity and 11 tissue components was studied in 116 adult wild mammals of 29 species and 13 families. Body weight ranged from 3 to 130,000,000 grams. In a series ranging from the shrew to the blue whale Body fatness = $1.50\ (FFBW)^{0.195}$ where FFBW is the fat-free body weight. In all species studied adipose tissue adapts itself to increasing body fatness by two mechanisms: (1) the fat fraction of existing adipose tissue increases to a limiting value of about 80 percent and (2) as this limiting value is approached, fat-free weight of the total adipose tissue present begins to increase indicating a hypertrophy of existing lipocytes, a proliferation of new lipocytes or both.

CHEMISTRY

National Institutes of Health, Bethesda, Md.
PIPETTING APPARATUS, by Harry Philip Marshall. Invention rept. [1958] 2p.
Order from LC mi$1.80, ph$1.80 PB 152 855

A sketch is presented of an apparatus consisting essentially of a vacuum line connected to a bell-shaped plastic tube into which any size pipette may be inserted.

Inorganic Chemistry

Office of Technical Services, Dept. of Commerce, Washington, D. C.
ALKALI METALS: LITHIUM, SODIUM, POTASSIUM, RUBIDIUM, AND CESIUM. July 60, 37p. 672 refs. OTS Selective Bibliography 421.
Order from OTS $0.10 OTS SB-421

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports listed cover the metals, alloys, and compounds of lithium, sodium, potassium, rubidium and cesium, as well as research on their toxicity, hazards, and safety in handling. These reports were added to the OTS collection during the period 1950 to July 1960.

Office of Technical Services, Dept. of Commerce, Washington, D. C.
ALKALINE EARTH ELEMENTS (BARIUM, CALCIUM, AND STRONTIUM). July 60, 21p. 335 refs. OTS Selective Bibliography SB-422.
Order from OTS $0.10 OTS SB-422

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports listed cover the metals and compounds of barium, calcium, and strontium, as well as research on their toxicity, hazards, and safety in handling. These reports were added to the OTS collection during the period 1950 to August 1960.

Organic Chemistry

Connecticut U., Storrs.
TRANSANNULAR REACTIONS OF FREE RADICALS, by Roy J. Gritter, Edward Sabatino, and Stanley Sacharow. Final rept. for 3 Mar 59-15 June 60 on Contract DA 19-020-ORD-4828. 50p. 21 refs. OOR rept. no. 2304. 1-C.
Order from LC mi$3.30, ph$7.80 PB 150 407

The first phase of this investigation was concerned with the possibility and extent of transannular reactions of free radicals in the substituted bicyclic ring system. The second phase concerned the photoisomerization of bicyclohepta-2, 5-diene derivatives to form the corresponding quadricyclic compounds. Another object of this investigation was to study the free radical chemistry of some compounds containing a medium-sized ring to determine whether or not a transannular free radical reaction could occur.

Edinburgh U. (Gt. Brit.)
REACTIONS RELATED TO OXIDATION, by T. Berces, W. E. Falconer and others. Final technical rept. no. 1, Sep 59-Sep 60, on Contract DA 91-591-EUC-1184. 28 Sep 60, 34p. 40 refs.
Order from OTS $1.00 PB 171 122

This report falls into four parts, each of which describes the application of a simple competitive method to the determination of the relative rates at which alkanes are attacked by oxygen-containing radicals that are involved in oxidations. Part 1. reports the completion of the key study in this series. The relative rates of consumption of mixed alkanes oxidized in static vessels with molecular oxygen have been measured. Hence the relative reactivities of the alkanes have been found. The nature of the attacking radicals, X, is not known but certain deductions can be made. The next stage is to compare the reactivities observed for X with those of known radicals. Part 2. reports the completion of a study of the reactions of methoxyl radicals generated by the pyrolysis of methyl nitrite and dimethyl peroxide. From this it can be seen that methoxyls do not play a significant part in oxidations. Some evidence of the absolute rates of methoxyl radical reactions has been obtained. Part 3. reports the relative rates of consumption of alkanes by the attack of radicals, presumed to be alkylperoxy generated by the photolysis of ketones in an excess of oxygen. The radicals react very similarly to X, which may therefore be a peroxy radical - at any rate at low temperature. Part 4. reports preliminary results in the reactions of hydroxyl radicals, which may be equivalent to X at high temperatures, produced by the photolysis of hydrogen peroxide in solution. (Author)

Little, Arthur D., Inc., Cambridge, Mass.
A SURVEY OF THE LITERATURE ON THE USE OF ORGANOMETALLIC COMPOUNDS IN THE PREPARATION OF ULTRA-PURE METALS, by W. A. G. Graham. Scientific rept. no. 1 on Contract AF 19(604)4975. 15 July 60, 42p. 122 refs. ERD-TN-60-768.
Order from OTS $1.25 PB 171 097

A survey of the literature on methods for recovering metals from organometallic compounds has been carried out. Possible recovery methods are thermal decomposition, photolysis, electrolysis, and hydrogenolysis. These have been appraised from the standpoint of contamination of the product by organic residues. Reaction of metals with gaseous organic free radicals has also been reviewed, but does not appear attractive as a means of purification. Reactions of organic free radicals in solution with metals are also discussed. (Author)

National Bureau of Standards, Washington, D. C.
VAPOR PRESSURES OF ORGANIC COMPOUNDS IN THE RANGE BELOW ONE MILLIMETER OF MERCURY, by E. E. Hughes and S. G. Lias. Oct 60, 26p. 115 refs. Technical note 70.
Order from OTS $0.75 PB 161 571

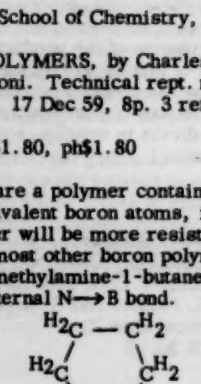
Data for vapor pressures less than one millimeter of mercury for over three hundred organic compounds have been collected. The values are presented in tabular form. No attempt has been made to evaluate the reliability of these data except where several investigators have studied the same compound over the same pressure range. A brief discussion of the methods and instruments which have been used to measure low vapor pressures is included. (Author)

Pennsylvania State U. Coll. of Chemistry and Physics, University Park.
STUDIES ON THE MECHANISM OF OLEFIN-ALCOHOL INTERCONVERSION. THE EFFECT OF ACIDITY ON THE O^{18} EXCHANGE AND DEHYDRATION RATES OF TERT-ALCOHOLS, by Robert A. Boyd, Robert W. Taft, Jr. and others. Technical rept. on Contract Nonr-656(03). Nov 59, 27p. 41 refs. AD-230 352.
Order from LC mi$2.70, ph$4.80 PB 150 538

Evidence from the acidity and temperature dependence of the rates of O^{18} exchange and dehydration of tert-alcohols have been obtained which indicates that these two reactions proceed by common initial steps but involve different rate determining steps. The results appear to eliminate a mechanism in which a "free" carbonium ion isomerizes to a π-complex in the rate determining step of the alcohol-olefin interconversion. Present results are found to be consistent with mechanisms which involve either the free carbonium ion or the encumbered carbonium ion intermediate, $R^+ \ldots OH_2$. The latter classification is proposed for intermediates which possess substantial carbonium ion character and involve measurable interactions between the cationic center and leaving or entering groups of either neutral or various charge types. The mechanism involving the encumbered carbonium ion intermediate is favored by the weight of earlier investigations. The Zucker-Hammett hypothesis is found to be invalid as a criterion of mechanism for the olefin-alcohol interconversion. The original basis for Taft's mechanism has accordingly been shown to be invalid. However, all of the subsequent lines of evidence which have been obtained are consistent with the modified mechanism in which the rate determining step involves the isomerization of two intermediates, π-complex and the encumbered carbonium ion. (Author).

Rutgers State U. School of Chemistry, New Brunswick, N. J.
STABLE BORON POLYMERS, by Charles E. Erickson and Edward G. Meloni. Technical rept. no. 1 on Contract Nonr-404(14). 17 Dec 59, 8p. 3 refs. AD-230 248.
Order from LC mi$1.80, ph$1.80 PB 152 087

Objective: To prepare a polymer containing B-O-B linkage having tetravalent boron atoms, in the expectation that the polymer will be more resistant to oxygen and moisture than most other boron polymers. Monomer Desired: 4-Dimethylamine-1-butaneboronic acid, probably with an internal N→B bond.



Prepared From: 4-Chloro-1-butaneboronic acid by treatment with dimethylamine. Present Status: The monomer has been made, but seems to be contaminated with a di-boronic acid, $(HO)_2BC_4H_8B(OH)_2$. The polymer obtained by removing water from the monomer is very viscous, partly because of cross-linking. It reacts with water extremely slowly as expected if boron is tetravalent. (Author)

University of Southern California, Los Angeles.
CHEMICAL BEHAVIOR AND BONDING OF BORON HYDRIDE DERIVATIVES, by Anton B. Burg. Technical rept. no. 5 on Contract Nonr-228(13). 1 Nov 59, 35p. 58 refs. AD-228 177.
Order from LC mi$3.00, ph$6.30 PB 150 519

Physical Chemistry

Catalysis Research Labs., Alfred U., N. Y.
FUEL CELL ELECTRODE PROCESSES. I. CATALYSIS AND CHEMISORPTION, by George J. Young and Ralph B. Rozelle. Technical rept. no. 1 on Contract Nonr-656(19). Nov 59, 56p. 16 refs. AD-232 641.
Order from LC mi$3.60, ph$9.30 PB 150 515

Chemisorption and catalysis were investigated with respect to electrode processes in low-temperature fuel gas cells. Hydrogen on metal electrodes: The over-all electrode reaction in a fuel gas cell with H and O is the oxidation of H to form H_2O. The cell potential is dependent on the electrode catalyst. The implication is that measured equilibrium free energy change is not between the gaseous reactants and the electrolyte but rather between the chemisorbed gases and the electrolyte. Measured values for hydrogen half-cell potentials were approximately a linear function of the heats of chemisorption at that portion of the surface which is active in the reaction. Hydrogen on metal oxide electrodes: Oxides of metals of the first transition series were studied as catalysts at the hydrogen electrode. The oxide electrode catalysts appeared to follow the same empirical correlation with the heats of chemisorption. Since the hydrogen electrode of the fuel cell can operate only by the reversible type chemisorption, the heats of hydrogen chemisorption obtained from the half-cell potentials contain no contribution from the irreversible mechanism. Catalysis of fuel cell electrode reactions: The activity of various groups of metals for both the fuel electrode and oxygen (air) electrode is discussed, giving a guide to the selection of catalysts for specific cell reactions.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
TEMPERATURE DEPENDENCE OF SUSPENDING POWER, by A. Mankowich. 15 Aug 60, 19p. 8 refs. CCL #96.
Order from LC mi$2.40, ph$3.30 PB 150 089

Temperature dependence studies of suspending power were made at 28°C and 82.2°C of three types of surfactants in built and unbuilt solution using a Cr_2O_3 powder. The powder was suspended well by both anionic and nonionic surfactants. Temperature coefficients

were small; and, in unbuilt solution, were negative for anionic SDBS and nonionic PGNPE, and positive for sodium oleate. Suspension isotherms in built and unbuilt solution appeared typical; and could be explained by the usual initial adsorption of detergent anions on the Cr_2O_3 particles until maximum zeta potential and suspendibility were attained, followed by sharp drops in suspendibility due to the neutralizing effect on the zeta potential of the increasing sodium ion concentrations. A theory for the positive temperature coefficient of sodium oleate was proposed. (Author)

Frick Chemical Lab., Princeton U., N. J.
INTER AND INTRAMOLECULAR POTENTIALS AND THE SPECTRUM OF ICE, by C. Haas and D. F. Hornig. Technical rept. no. 3 on Contract Nonr-1858(27). 25 Nov 59, 20p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 150 858

Whereas the spectra of H_2O and D_2O ice cannot yet be explained unambiguously, the spectra of HDO in dilute solution in either H_2O or D_2O may be interpreted readily. In particular, since ν_{OH} occurs at 3275 cm^{-1} and $2\nu_{OH}$ at 6300 cm^{-1}, nearly the harmonic value, the barrier to proton transfer lies well above the latter level and must exceed 23 k. cal/mole. The width of ν_{OD} at 2416 cm^{-1} is only 20 cm^{-1}, whereas that of ν_{OH} is about 80 cm^{-1} and $2\nu_{OH}$ about 600 cm^{-1}. These widths can be explained by proton tunneling if the barrier height is near 32 k. cal., in which case the second minimum must lie below the level ν_{OH}. It must therefore be less than 14 k. cal/mole above the primary minimum A doubling of ν_{OD} from OD...OD pairs was also observed and the magnitude of the splitting is consistent with an effective charge of 0.6e on the protons. It is clear from these results that the usual width of hydrogen bonded OH lines is not an intrinsic characteristic of the O-H...O bond but results largely from intramolecular coupling of the O-H motions. (Author)

Institute de Quimica Fisica (Spain).
KINETICS OF THE SULPHURATION OF METALLIC SURFACES, by J. Llopis, J. M. Gamboa, and L. Arizmendi. Final rept. on Contract AF 61(514)1329. May 60, 82p. 13 refs. AFOSR-TR-60-73.
Order from LC mi$4.80, ph$13.80 PB 150 334

A study has been made of the surface reaction of copper and platinum with aqueous solutions of thiourea labelled with S^{35} and C^{14}. The results suggest that a tarnishing reaction takes place at the surface of the copper, probably forming a film of copper sulfide. The kinetics of this reaction may be expressed by the equation

$$\frac{\Delta^2}{k_d} + \frac{\Delta}{k_r} = t;$$

the plot of log k_r against $\frac{1}{T}$ is linear, the slope corresponds to an energy of activation $\Delta H_r^{\ddagger} = 10.9$ Kcal/mol; the plot of log k_d against $\frac{1}{T}$ gives two straight lines.

The reaction with platinum finishes with the formation of a few monolayers and the kinetics may be given by a logarithmic law. Research has been extended to study the surface reaction of copper with solutions of diphenylthiourea in xylene; this reaction yields coherent films showing interference colors. The surface reaction of copper with aqueous solutions of methylthiourea and of sodium polysulphide has been studied. The reactions of copper and silver with benzene solutions of sulfur have also been studied. (See also PB 143 681)

Iowa State U. of Science and Tech., Ames.
RESEARCH ON HEAT CAPACITY LAG IN GASES, by Sam Legvold and L. M. Valley. Final rept. on Contract AF 18(600)1496. Aug 60, 6p. 6 refs. AFOSR TR-60-109
Order from LC mi$1.80, ph$1.80 PB 150 458

Laboratori di Elettrochimica, Chimica Fisica e Metallurgia del Politecnico di Milano (Italy).
RESEARCHES ON HYDROGEN OVERVOLTAGE ON METALLIC SINGLE CRYSTALS: TIN, by L. Peraldo Bicelli and A. La Vecchia. Rept. for June-Dec 59 on Surface and Interface Phenomena Matter, Contract AF 61(052)144. July 60, 19p. 15 refs. WADD Technical note 60-115.
Order from OTS $0.50 PB 171 079

Hydrogen overvoltage on tin single crystal cathodes, oriented following the (001), (100), (110), planes and on polycrystalline tin, has been measured in perchloric acid solutions with two different concentrations and in hydrochloric acid solutions. Tafel law holds true; while the parameters are different for the different electrodes. (Author)

Laboratory of Atomic and Solid State Physics, Cornell U., Ithaca, N. Y.
SATURATION AND DOUBLE-FREQUENCY IRRADIATION STUDIES OF THE TWO-PROTON SYSTEM IN $CaSO_4 \cdot 2H_2O$, by D. F. Holcomb and T. R. Sliker. Technical rept. no. 4 on Contract Nonr-401(15). 29 Dec [59] 30p. 12 refs. AD-234 160.
Order from LC mi$2.70, ph$4.80 PB 152 088

A number of experiments have been performed on the proton spin system in $CaSO_4 \cdot 2H_2O$ with RF power level sufficient to appreciably saturate the nuclear spin resonance. Observations were made of the dispersion and absorption modes in a standard CW experiment. In the dispersion mode, at RF levels such that the RF magnetic field, H_1, was greater than 0.1 gauss, a third dispersion line appears in the center of the unsaturated two-line pattern. This extra line may arise from a double-quantum process, involving absorption of two "photons" from the RF oscillator field. In a second set of experiments, two radio frequency oscillators were employed. One oscillator, operating at large H_1, produced a large power absorption at one frequency while the other, low-level oscillator was used to sample the absorption line shape in the presence of the large H_1 by sweeping the frequency of the low-level oscillator. Using crossed coils, the oscillators could be operated with their frequencies differing by as little as 5 kc/sec, at 12 mc/sec, without interacting strongly. In these experiments, small changes in line shape, and a surprising enhancement of the absorption signal from one line while saturating the other were observed. The presence of this enhancement demonstrates the existence of multiple spin flip relaxation processes. (Author)

Louisiana State U., Baton Rouge.
STRUCTURE OF THE DOUBLE LAYER AND ELECTRODE PROCESSES. II. EFFECT OF THE NATURE OF THE ELECTRODE AND APPLICATION OF THE THALLIUM AMALGAM ELECTRODE, by Paul Delahay

and Marcos Kleinerman. Technical rept. no. 40 on Contract Nonr-300(00). Nov 59, 28p. 26 refs. AD-230 194.
Order from LC mi$2.70, ph$4.80 PB 150 870

The influence of the nature of the electrode in electrochemical kinetics in the absence of specific electrode effects, is interpreted on the basis of a change in the double layer structure. This double layer effect should also be considered in kinetic correlations for processes with specific electrode effects. Application is made of the dropping thallium-amalgam electrode (up to 31% Tl) for which the point of zero charge can be shifted continuously by as much as -0.4 v with respect to this point for Hg. The following reductions are studied: bromate and iodate in alkaline solution, hexacyanochromate (III) in cyanide medium, chromate in alkaline solution, and tetracyano cadmium (II) in cyanide medium. Shifts of the Tafel line for bromate and variations of the exchange current density for hexacyanochromate (III) are interpreted quantitatively. Chromate waves for the dropping thallium amalgam electrode in supporting electrolyte of low concentration exhibit a pronounced minimum which is quantitatively discussed. The maximum in the tetracyano cadmium (II) waves is abscribed to a double layer effect in agreement with other investigators, and a quantitative study is attempted for the results obtained with the dropping Hg electrode. (Author)

Massachusetts Inst. of Tech., Cambridge.
HYDROGEN PEROXIDE LABORATORIES, by C. N. Satterfield. Quarterly periodic status rept. on Contract Nonr-1841(11). 31 Dec 59, 12p. DSR 5-7476; AD-231 415.
Order from LC mi$2.40, ph$3.30 PB 152 095

Hydrogen peroxide decomposition flame: Shadowgraphs were made of H_2O_2 flames which were stabilized at atmospheric pressure at the tip of a Pyrex burner. Measurements were made of the flame velocities and the energy of activation (E) of the H_2O_2 decomposition. Calculations produced an E of 26.7 kcal/mole which was in excellent agreement with experiment. Shadowgraphs of H_2O_2 flames at sub-atmospheric pressures indicated a laminar flow in the burner tube. Porous walled reactor studies: Experiments in a porous stainless steel reactor were made by using N-H_2O_2-H_2O vapor mixtures with and without the injection of N through the porous wall. The rate constants for first-order decomposition of H_2O_2 on porous stainless steel varied from 5.4×10^{-4} to 7.3×10^{-4} g-mole/$(cm)^2$(M)(atm), depending on the temperature of the surface and the flow rate of the gas in the reactor. Decomposition of H_2O_2 vapor on catalytic surfaces: Decomposition of 0.28 mole-% H_2O_2 was studied inside a Cu tube at 40°C. The ratio of the measured reaction rate to that predicted by assuming complete mass transfer control increased from .02 to .06 with time. An Ag tube was oxidized by being anodized in a NaOH solution, then used as a catalyst tube. There was no decrease of activity with time, even after washing with NH_3 solution, and with H_2O_2 solution followed by NH_3 solutions. The reaction rate remained about 0.75 of the rate predicted by mass transfer correlations. (See also PB 146 281)

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
DISSOLUTION KINETICS AT DISLOCATION ETCH PITS IN SINGLE CRYSTALS OF LITHIUM FLUORIDE, by M. B. Ives and J. P. Hirth. Technical rept. no. 4 on Contract Nonr-760(17). 1 Dec 59, 35p. 14 refs. AD-232 562.
Order from LC mi$3.00, ph$6.30 PB 152 089

Dissolution at dislocation etch pits in lithium fluoride dissolving in a dilute aqueous solution of ferric fluoride did not follow the kinetic laws predicted by the current topographical or mechanistic theories of crystal dissolution. The results were consistent with the mechanistic theory involving dissociation of lithium fluoride from monomolecular steps on a lithium fluoride and subsequent diffusion into solution, if a time-dependent adsorption of ferric fluoride "poison" at the receding monomolecular steps was invoked. Deviations from the topographical dissolution theory of Frank [Growth and Perfection of Crystals, p. 411, Wiley and Sons, N. Y., 1958] could also be explained by this time-dependent model. The experimental results could only be qualitatively compared with theoretical predictions because of the complexity of the time-dependent dissolution process. (Author)

Milan U. (Italy).
ELECTROCHEMICAL BEHAVIOUR OF OXYGEN AND HYDROGEN PEROXIDE ON SILVER ELECTRODES, by G. Bianchi, G. Caprioglio and others. Technical (scientific) note no. 1 on Contract AF 61(052)260. May 60, 41p. 21 refs. AFOSR-TN-60-299.
Order from LC mi$3.30, ph$7.80 PB 150 336

The electrochemical behaviour of oxygen and hydrogen peroxide on silver electrode was studied by means of polarization curves. In acid and neutral solutions the process $Ag \rightleftarrows Ag+$ interferes with those of the system H_2O - H_2O_2 - O_2. The reduction of O_2 and that of H_2O_2 occur in the same way at 0,15 V. The tension is independent from the pH. In alkaline solutions the reduction of O_2 occurs at 0,2 V and the oxide film covering the electrode does not interfere. The reduction of H_2O_2 occurs through its decomposition in H_2O and O_2 and the successive reduction of oxygen according to the process $O_2 + H_2O + 2e \rightarrow HO_2^- + OH^-$. The anodic formation of silver oxides is showed, but does not interfere with the oxidation of H_2O_2 that occurs at a lower tension (0,18 V). (Author).

National Bureau of Standards, Washington, D. C.
SOME EXPERIMENTS ON THE DEPOSITION OF GASES AT 4.2°K, T. Baurer. Oct 60, 34p. 10 refs. Technical note 73.
Order from OTS $1.00 PB 161 574

In order to develop some preliminary information concerning the very basic problems of gaseous deposition at extremely low temperatures, samples of argon, nitrogen, oxygen, and hydrogen were deposited at 4.2°K, and variations in some of the parameters associated with these depositions were observed. In addition, samples of the same gases were passed through an excitation zone prior to deposition, and differences

in the deposition behavior were recorded. The pressure downstream of the deposition region and the temperature within the deposited solids were found, in general, to increase with flow rate of the depositing substances, and to vary with time in a manner depending on the density, flow rate, and state of excitation of the incoming gases. Arrhenius curves were plotted using warmup data observed in these experiments and solid-phase transition data determined elsewhere. Variations in the positions of these plots were sometimes the result of differences in the conditions of deposition, and at other times an effect of the chemical nature of the gas studied. The experimental behavior of hydrogen, relative to that of the other gases studied, was observed to be strongly dependent upon its much higher thermal conductivity. (Author)

Northwestern U., Evanston, Ill.
CATALYTICALLY ACTIVE SOLIDS, by P. W. Selwood. Final rept. on Contract Nonr-1228(08). 31 Dec 59, 3p. 9 refs.
Order from LC mi$1.80, ph$1.80 PB 152 126

Brief summary listing publications prepared under the contract

Northwestern U., Evanston, Ill.
CATALYTICALLY ACTIVE SOLIDS. CHEMISORPTION AND MAGNETIZATION, by Robert E. Dietz. Technical rept. on Contract Nonr-1228(08). 1 Nov 59, 156p. 78 refs. AD-230 202.
Order from LC mi$7.50, ph$24.30 PB 150 536

A study was made of unpaired electrons before and after chemisorption in order to gain a more complete description of the H-Ni chemisorption bond. The immediate objectives were to determine the effect of chemisorbed H on the saturation magnetization of fine Ni particles, and to determine the influence of particle size and mode of preparation of the sample, conditions of adsorption, and other physical factors on these changes. The following measurements were made: (1) magnetization-field intensity measurements, (2) analysis of Ni in the samples, and (3) pressure-volume measurements to determine the volume of gas adsorbed by the samples. For sintered samples containing particles of radius of the order of 60 A, the saturation, magnetization of the sample was within 1% of that of massive, polydomain Ni. Hydrogen decreased the saturation magnetization by 0.4 to 0.7 by and 0.6 to 0.8 Bohr magnetrons for unsintered and sintered samples, respectively. Hydrogen was concluded to be bound to the Ni surface by bonds of nature intermediate between the metallic-type bonds of the Ni, and purely ionic contributions as in the Pd-H system. A phenomenological theory was developed which successfully related the changes in the low-field magnetization to variables such as surface coverage, temperature, magnetic field intensity, and the nature of the distribution of particle size. The saturation experiments were in approximate agreement with the low-field studies.

Office of Technical Services, Dept. of Commerce, Washington, D. C.
MOLTEN AND FUSED SALTS. Aug 60, 9p. 135 refs. OTS Selective Bibliography SB-425.
Order from OTS $0.10 OTS SB-425

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. This bibliography includes reports added to the OTS collection during the period 1950 to September 1960.

Ohio State U. Research Foundation, Columbus.
A STUDY OF THE INFRARED SPECTRA OF FLAMES USING PHASE-DISCRIMINATION METHODS OF DETECTION, by Fred P. Dickey, Norman Gailar and others. Final rept. on Contract AF 19(604)2254. July 60, 76p. 35 refs. AFCRL-TR-60-403.
Order from LC mi$4.50, ph$12.30 PB 150 755

This report is about the application of phase-discrimination methods of detection to overcome some of the difficulties resulting from the masking effects of the strong emission due to water vapor. These same methods could be extended to overcome masking effects of carbon dioxide or any other molecular radiation source. To date, two different methods of taking observations have been used, and they accomplish essentially the same end result. In a given individual study one method may have some advantage over the other.
Included in the report are:
Emission spectrum of the OH radical in an oxy acetylene flame, pub. in The Jnl. of Chemical Physics 28:1253, June 58
28:1253, June 58
Application of phase-discrimination method of detection to the study of the spectrum of the OH radical in an oxyacetylene flame, pub. in Seventh Symposium (International) on Combustion, p. 938-941, 1959.
Emission spectrum of the OH radical in an oxyacetylene flame in the 1.5μ region, pub. in The Jnl. of Chemical Physics, Aug 60.

Pennsylvania State U. Coll. of Chemistry and Physics, University Park.
SOLVENT EFFECTS ON MESOMERIC CHARGE SEPARATION, by Robert W. Taft, Jr., Richard E. Glick and others. Technical rept. no. 23 on Contract Nonr-656(05). Nov 59, 4p. 11 refs. AD-230 353.
Order from LC mi$1.80, ph$1.80 PB 150 539

The contribution to the resonance hybrid of dipolar resonance structures as enhanced by solvents which support ionization was studied. The phenomena based upon shielding parameters from the nuclear magnetic resonance spectra of m- and p-substituted fluorobenzenes. Emphasis was placed on the quantity $-(f_p^F - f_m^F)$, the mesomeric charge perturbation (m. c. p) at the F^{19} nucleus. The m. c. p. 's were measured for a variety of typical -R and +R substituents in cyclo-C_6H_{12}, CCl_4, MeOH, and 75% aqueous MeOH at infinite dilution. The results indicated that to good approximation ($\pm \sim 5$ c), the m. c. p. 's for most -R substituents are an intramolecular property independent of solute-solvent interactions. In nonhydroxylic solvents, the m. c. p. 's for OH and NH_2 substituents had fixed values. In hydroxylic solvents, the m. c. p. 's were increased for the OH substituent and decreased for the NH_2 substituent. The m. c. p. 's for every +R substituent substantially decreased with the increasing ability of the solvent to support ionization. These solvent effects were ascribed to the increased contribution to the resonance hybrid of the isovalent dipolar resonance forms with increased (ionizing-supporting) solute-solvent interactions.

Royal Inst. of Tech. (Sweden).
THE FIRST STEP IN THE ACIDIFICATION OF WO_4^{2-}; EQUILIBRIA IN 3 M $NaClO_4$ AT 25°C, by Yukiyoshi Sasaki. Technical note no. 8 on Contract AF 61(052)162. 19 June 60, 28p. 37 refs. AFOSR-TN-60-178.
Order from LC mi$2.70, ph$4.80 PB 150 335

The reaction between H^+ and the wolframate ion, WO_4^{2-} has been studied at 25°C in 3 M $NaClO_4$ medium using a glass electrode. The main reaction was found to be: $7\ H^+ + 6\ WO_4^{2-} \rightleftarrows 3\ H_2O + HW_6O_{21}^{5-}$ with the equilibrium constant log K = 60.68 ± 0.03. On further acidification, a range with slow reactions was encountered. The product $HW_6O_{21}^{5-}$, which is probably identical with the "para-wolframate A" of Souchay and others undergoes a slow reaction which does not seem however to disturb the present data. (Author).

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
METHODS OF ANALYSIS OF NEARLY FREE MOLECULAR FLOW FOR A SATELLITE OR OTHER SPACE VEHICLE, by D. Roger Willis. Rept. on Contracts AF 49(638)465 and AF 04(647)269. Aug 60, 32p. 21 refs. Technical Information Series R60SD399.
Order from LC mi$3.00, ph$6.30 PB 150 170

When a satellite or other space vehicle descends below a certain altitude, some intermolecular collisions must be considered. Various methods suggested for the analysis of such nearly free molecular flow problems are discussed. A formal iterative method of solving Boltzmann's equation for the distribution function is presented. It is shown that the first collision methods represent an approximation to the calculation of the first iterate in the proposed method, when the zeroth iterate is taken as the free molecular solution. The results of calculations for a sphere in a high speed ratio flow, with emergent molecules of various energies, are presented. These offer quantitative justification of some of the assumptions used in the methods in the literature, which were limited to low energy emergent molecules. However, it appears that the results of those methods cannot be extrapolated to higher energy emergent molecules, without paying due regard to the molecular model employed. (Author).

Stanford Research Inst., Menlo Park, Calif.
DIFFUSION AND HETEROGENEOUS REACTION. III. ATOM RECOMBINATION AT CATALYTIC BOUNDARY, by Hans Motz and Henry Wise. Rept. on Project Squid, Contract Nonr-1858(25). Dec 59, 5p. 4 refs. Technical rept. SRI-5-P.
Order from LC mi$1.80, ph$1.80 PB 152 152

See also PB 139 187

Stanford Research Inst., Menlo Park, Calif.
PHOTOCHEMICAL SYSTEMS FOR SOLAR ENERGY CONVERSION: NITROSYL CHLORIDE, by Rudolph J. Marcus and Henry C. Wohlers. Scientific rept. no. 1 on Contract AF 19(604)7302, continuation of Contract AF 19(604)3477. 15 Aug 60, 52p. 66 refs. SRI Proj. SU-3223; AFCRL-TN-60-639.
Order from LC mi$3.60, ph$9.30 PB 150 627

The desirable properties of photochemical conversion reactions are discussed and a number of possible reactions are listed and rated. Studies of one of these, the photolysis of nitrosyl chloride, are reported. The solar furnace was used as a light source for these studies. All available physical, photochemical, and thermochemical data on nitrosyl chloride, chlorine, and nitric oxide have been gathered and are reported here. (Author)

Stanford Research Inst., Menlo Park, Calif.
THEORETICAL STUDY OF HIGH TEMPERATURE COMPOUNDS, by A. P. Brady, R. J. Marcus and R. M. Silverstein. Technical rept. no. 2 on Contract Nonr-2629(00). 9 Dec 59, 27p. 47 refs. SRI Project no. SU-2625; AD-230 601.
Order from OTS $0.75 PB 171 103

Four general routes for decomposition are considered: homolysis, homolysis followed by radical chain reaction (and a special case of this, commonly termed "unzipping"), four-center mechanisms, and cleavage by partner exchange. A compilation of isoteniscope "decomposition points" is given and selected examples are discussed in terms of possible decomposition mechanisms. Four-center types of mechanisms of decomposition, usually involving formation of a new double bond (as does unzipping), are fairly easily avoided, and none of the more promising high temperature compounds is susceptible to this mode of decomposition. Cleavage by partner exchange can occur when there are unused orbitals. It can be alleviated to some extent by surrounding this atom with bulky groups. Interpretation of most of the extant pyrolysis data is hampered by lack of simultaneous information on rates, activation energy, and initial products of decomposition. However, the data that are available are compatible with decomposition via radical chain reactions. Two compounds, terphenyl and diphenylmethane, are discussed in some detail from this standpoint, and a number of others discussed in general. Three speculative lines of synthesis are discussed. One involves a boron-triazine backbone, the second a poly-perfluorocyclohexyl ether, and the third a special P-O-Si backbone for a "flexible glass." (Author)

Texas U. [Austin]
ELECTRODE PROCESSES, by L. O. Morgan. Final rept. on Contract Nonr-375(04). Dec 59, 12p. 10 refs. AD-232 403.
Order from LC mi$2.40, ph$3.30 PB 152 097

Electrode potential changes were correlated with adsorption of Cr (VI) anions on Cr metal surfaces. Active and passive surfaces differed in the rate of adsorption. Etched Cr was similar to active Cr with respect to potential behavior but had a much larger apparent surface area. Prolonged aging of aqueous solutions of $Cr_2(SO_4)_3$ at 40°C caused the formation of species which prevented free precipitation of about 1/3 of the total sulfate present. Four fractions were recognized in aged solutions of $Cr_2(SO_4)_2$ separated by elution from Dowex-50 with NH_4NO_3 solution. A proposal was made for the electrolytic oxidation of chlorate to perchlorate at a Pt anode. PtO_3 forms at the anode surface under conditions favorable for chlorate oxidation, and an intermediate species is formed be-

tween the oxide and chlorate ions. The intermediate species then decomposes into PtO_4 and ClO_4 ions. A study was made of the sorption of (W) under conditions varied as to pH, tungstate concentration, and the presence of other anions. Experiments were conducted to utilize proton relaxation measurements on aqueous solutions of Cr (III) salts.

Ultrasonics Research Lab., Western Reserve U., Cleveland, Ohio.
A. C. STREAMING POTENTIALS, by Irving Galperin, Ernest Yeager, and Frank Hovorka. Technical rept. 21 on Contract Nonr-1439(04). 1 Dec 58, 71p. 28 refs. AD-229 511.
Order from LC mi$4.50, ph$12.30 PB 152 132

Streaming potential measurements, ac and dc, were made with porous packings consisting of ion exchange resins, Pyrex glass wool, nylon, and cotton in a large number of aqueous solutions. Special apparatus was developed for the ac measurements at frequencies from 0 to 30. Results by both methods are in substantially complete agreement. No frequency dependence was found over the limited range involved in the present work. The dependence of the streaming potentials on type and concentration of electrolytic solution is the same as would be predicted on the basis of published results obtained by conventional dc methods. With ion exchange resins such as Amberlite IR-120-Na, the streaming potentials were found to increase only 10% when the particle diameter was reduced from 400 to 40μ. This is in agreement with theory. (Author)

Washington U., Seattle.
SOLUBILITY OF HYDROGEN AND DEUTERIUM IN LIQUID ARGON, by H. Volk and G. D. Halsey, Jr. Rept. on Contract AF 49(638)723. 15 July 60, 27p. 18 refs. AFOSR TN-59-1210; AD-242 750.
Order from LC mi$2.70, ph$4.80 PB 150 461

The solubility of hydrogen and deuterium in liquid argon at pressures from 10 to 100 atm is reported. Solubility isotherms have been measured between 87° and 140°K for hydrogen and between 87° and 120°K for deuterium. The dependence of Henry's constant on temperature, pressure and concentration, the heats of solution, the partial molar volume of hydrogen in liquid argon and the second virial coefficients of hydrogen and deuterium in the liquid solution are reported. The increase in the solubility of deuterium over hydrogen is 21.3%, 20.2% and 18.5% respectively at 87, 100 and 120°K. This isotope effect is discussed as a quantum correction to the free volume. Comparison between theory and experiment indicates that the LJD free volume is too large by approximately a factor of five. (Author).

EARTH SCIENCES

Aeronautical Chart and Information Center, St. Louis, Mo.
GEODETIC DISTANCE AND AZIMUTH COMPUTATIONS FOR LINES UNDER 500 MILES. Rev. ed. Sep 60, 84p. 57 refs. ACIC Technical rept. no. 59.
Order from OTS $2.25 PB 171 067

This report is a study of various methods of computing geodetic distance and azimuth. Lines in various latitudes at different azimuths were used for testing the methods. Methods were evaluated for simplicity, rapidity, and accuracy (within an allowable error of ten feet in distance and one-tenth of a degree in azimuth). No lines longer than 500 miles were studied. When positions are given in terms of geographic coordinates, this report recommends that the method developed by Colonel Ewing be used for the computation of the distance and azimuth of lines as long as 500 miles. When positions are given in terms of Universal Transverse Mercator Grid Coordinates only, this report recommends that the method devised by Major Hopkins and revised by ACIC be used for the computation of distance and azimuth of lines as long as 500 miles. (Author)

Massachusetts Inst. of Tech., Cambridge.
RESEARCH ON THE PHYSICAL PROPERTIES OF MARINE SOILS. Summary progress rept. for Aug 58-July 59 on Contract Nonr-1841(29). Nov 59, 10p. 5 refs. AD-229 369.
Order from LC mi$1.80, ph$1.80 PB 150 862

Research was conducted to develop knowledge on the change of soil properties with time and environment. Experiments indicate that the strength of a clay depends upon pressure, time, water content, electrolyte concentration, valence of exchangeable cation, size of hydrated exchangeable cation, dielectric properties of the pore fluid, cations in the pore fluid, pH, temperature and disturbance. Decrease in temperature of a compacted kaolinite resulted in loss of strength, while small amounts of salt added to the pore fluid of a clay increase the strength of the material. The effect of time (elapsed time and strain rate) on the shear strength of kaolinite was investigated with triaxial equipment. The effects of changes in pH, salt (NaCl) concentrations, and temperature were studied. The literature indicates that many fine-grained soils contain carbonates and/or ferric oxides, and/or organic matter which cement the soil particles into aggregants. The effects of potassium fixation by expandable clays (degraded illites, vermiculite, and beidellite-type montmorillonites) was studied. Fixation of potassium caused these clay minerals to change to illite. A clay containing 70% illite and 10 to 15% collapsible vermiculite decreased in void ratio up to 10% when KCl was added to the permeating NaCl solutions. Consolidation tests were performed on these clays sedimented in NaCl solutions at 2 to 1000 psf. Upon completion of the consolidation tests, the clays were tested in unconfined compression. They failed like brittle materials with well-defined shear planes; the strengths were extremely susceptible to small moisture changes.

Climatology and Meteorology

Army Signal Research and Development Lab., Fort Monmouth, N. J.
LAYER-CLOUD HEIGHT MEASUREMENT WITH STORM-DETECTION RADARS, by Donald M. Swingle and Abraham Golden. 15 July 60, 21p. USASRDL Technical rept. 2135; AD-241 179.
Order from LC mi$2.70, ph$4.80 PB 152 193

A theory is developed for determining the elevation angle at which a radar set can most accurately measure the heights of the tops and bases of layer clouds. A working chart is provided which permits operators of AN/MPS-34, AN/CPS-9 and AN/APQ-13 weather radars to determine: (1) cloud height (including standard corrections for earth curvature) from range and elevation angle data, (2) optimum elevation angle for measuring layer cloud heights and (3) corrections to indicated heights to account for pulse-length and beam-width distortions. (Author).

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PREFLIGHT CONDITIONER FOR HUMIDITY ELEMENTS, by Quentin Frazier. 22 July 60, 28p. USASRDL Technical rept. 2137; AD-241 875.
Order from LC mi$2.70, ph$4.80 PB 152 195

Development is reported of a device for field conditioning and calibrating of resistance-type humidity elements such as those used in meteorological sounding equipment. The principle requirement for this device is as an auxiliary equipment to humidity-temperature measuring set AN/AMQ-7 and vortex psychrometer set AN/AMQ-13. This device is used to measure, control, and maintain specific moisture and temperature environments as obtained by exposure over supersaturated aqueous solutions of various inorganic salts. Design features of the chamber include a test section, a humidity control system, a humidity ventilation system, and a temperature control system. The design of each of the 4 systems of 2 experimental models is described. Problem areas, such as the elimination of temperature stratification in the element test section and the achievement of good humidity measurement and control are discussed. Design of a third experimental model is recommended as a basis for a production model.

Bureau of Ships, Washington, D. C.
MICROMETEOROLOGICAL STUDIES AT SEA, by Paul M. Wolff. Dec 58, 73p. 4 refs.
Order from LC mi$4.50, ep$13.80 PB 152 273

The installation and operation of a micrometeorological facility aboard a converted Liberty ship is described. The observations from three cruises off the California coast are listed. A brief analysis of temperature and wind structure in the lowest one hundred feet of the marine atmosphere is made. Some remarks are included on diffusion at sea and on the flow of air around moving ships.

Durham U. [Gt. Brit.]
RESEARCH ON THE ELECTRICITY OF RAIN, by J. Alan Chalmers, J. E. Maund and others. Final technical rept. for 1 Oct 56-30 Sep 59, on Contract AF 61(614)1072. [1959] 43p. 29 refs. AFCRC TR-60-227.
Order from LC mi$3.30, ph$7.80 PB 150 929

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Point Discharge

Imperial Coll. of Science and Tech., London (Gt. Brit.)
RADAR SCATTER BY LARGE HAIL, by D. Atlas, F. H. Ludlam and others. Technical (scientific) note no. 2 on Contract AF 61(052)254. Jan 60, 38p. 11 refs. AFCRC-TN-59-663.
Order from LC mi$3.00, ph$6.30 PB 150 420

Radars with wavelengths of 3.3 and 4.67 cm have been used to measure the back-scatter cross-sections of individual artificial hailstones and their variations as melting occurs. The measurements confirm the cross-sections computed theoretically. An ice sphere is a better scatterer than a liquid water sphere of equal size when its diameter exceeds 0.8 wavelengths; when the diameter lies between 1.2 and 2.3 wavelengths it is better by a factor of 10 or more. This behaviour of ice is supported by scatter measurements on a set of plexiglass (perspex) spheres with refractive index close to that of ice. When melting begins, the 3.3 cm cross-sections drop sharply toward the all-liquid values; those at 4.67 cm decrease gradually, and sometimes not at all. The implications are that: (1) a water coat of 0.01 cm thickness has a major effect at 3.3 cm and a minor one at 4.67 cm; (2) liquid continues to collect in subsurface cracks and cavities in the ice and causes a further decrease in the cross-sections after the maximum thickness of water coat has formed. The final cross-sections are generally within 2 db of the all-liquid value after 7 to 10 minutes of melting at 3.3 cm and after 15 to 20 minutes at 4.67 cm.

International Inst. of Meteorology, U. of Stockholm (Sweden).
ON VERTICAL MOTIONS AND TRANSVERSAL CIRCULATIONS AT THE EASTERN AND WESTERN SIDE OF LONG-WAVE DISTURBANCES IN THE SUMMER SUBTROPICAL JETSTREAM, by Friedrich Defant. [Technical (scientific) note no. 7] on Contract AF 61(514)963. [1959] 66p. 9 refs. AFCRC-TN-60-226; AD-234 544.
Order from LC mi$3.90, ph$10.80 PB 148 262

This report is part of investigations on the General Circulation of the Atmosphere, with special emphasis on upper atmospheric layers.

International Inst. of Meteorology, U. of Stockholm (Sweden).
RESEARCH ON STRATOSPHERIC METEOROLOGY, by Fr. Defant. Technical (final) rept. on Contract AF 61(514)963. 31 Dec 59, 51p. 6 refs. AFCRC-TR-60-229.
Order from LC mi$3.60, ph$9.30 PB 150 930

International Inst. of Meteorology, U of Stockholm (Sweden).
A SYNOPTIC INVESTIGATION OF THE FLOW AND MASS FIELD IN THE CLOSE VICINITY OF THE SUMMER SUBTROPICAL JET STREAM RELATIVE TO THE JET-AXIS, by Friedrich Defant. Technical (scientific) note no. 6 on Contract AF 61(514)963. [1959] 71p. 8 refs. AFCRC TN-60-227; AD 234 373.
Order from LC mi$4.50, ph$12.30 PB 148 263

This report is part of investigations on the General Circulation of the Atmosphere, with special emphasis on upper atmospheric layers.

Ionosphere Research Lab., Pennsylvania State U., University Park.
IONOSPHERIC ELECTRON DENSITIES FOR WASHINGTON, D. C., PANAMA, TALARA, AND HUANCAYO, APRIL-JUNE, 1958, by E. R. Schmerling. Scientific rept. no. 128 on Ionospheric Research, Contract AF 19(604)3875. 15 Jan 60, 295p. AFCRC TN-60-267; AD-234 480.
Order from LC mi$11.10, ph$45.60 PB 148 256

See also PB 142 411.

[Laboratory of Climatology, Centerton, N. J.]
ANNOTATED BIBLIOGRAPHY ON PRECIPITATION CHEMISTRY, by John R. Mather. Appendix no. 3 to Final rept., Technical note no. 2 on Contract AF 49(638)409. [1960] 58p. 147 refs. AFOSR-TN-60-876; AD-241 893.
Order from LC mi$3.60, ph$9.30 PB 150 617

Types of precipitators involved include: rain water, dew, fog, cloud, hoar-frost, rime and snow. The bibliography includes an author index, a subject outline, and a geographical outline. (See also PB 150 614)

Naval Ordnance Test Station, China Lake, Calif.
AN IMPROVED TIME-ALTITUDE METHOD FOR COMPUTING WINDS ALOFT USING RAWINSONDE DATA, by Paul H. Miller. 19 May 60, 15p. 3 refs. NOTS TP 2486; NAVWEPS rept. 7076.
Order from LC mi$2.40, ph$3.30 PB 150 867

A simplified and readily applicable technique was developed for rapidly obtaining more accurate winds-aloft data based on rawinsonde information. The method employs either meters or feet and may be reduced as levels either above the surface or above mean sea level. (Author).

New York U. Coll. of Engineering, N. Y.
DROPLET COLLISION EFFICIENCY, by R. M. Schotland. Final rept. on Contract AF 19(604)2135. July 60, 20p. 4 refs. GRD-TR-60-292.
Order from LC mi$2.40, ph$3.30 PB 150 437

An experimental study has been made of parameters which control the coalescence of drops in the diameter range 200 to 800 microns with large liquid hemispherical targets. It is shown that the initiation of the coalescence mechanism for electrically neutral drops in equilibrium with their vapor is governed by two dimensionless parameters: $\pi_1 = \rho_D V_N^2 D/\gamma$, $\pi_2 = \rho_M/\rho_D$ where ρ_D = drop density, ρ_M = medium density, γ surface tension, V_N = normal component of impact velocity, and D = drop diameter. (Author).

Quartermaster Research and Engineering Center, Natick, Mass.
SOME OBSERVATIONS OF THE EFFECT OF DIRECT AND SNOW-REFLECTED SOLAR RADIATION ON EXPOSED AND SHIELDED THERMOCOUPLES, by Fernand de Percin. Apr 58, 7p. 2 refs. Research Study rept. RER-19.
Order from LC mi$1.80, ph$1.80 PB 152 070

This report released for sale to the public 7 Nov 60.

Tentative conclusions drawn from this brief study are as follows: (a) Well-shielded thermocouples of any size will measure temperatures closely corresponding to those recorded in the standard type instrument shelter. (b) Exposed, bare thermocouples will be affected by solar radiation, and temperatures recorded will usually be higher than those obtained from shielded thermocouples or by thermograph readings in an instrument shelter. (c) Exposed, white-coated thermocouples were affected by solar radiation almost as much as the bare thermocouples. (d) Small gauge shielded thermocouples (36-gauge or smaller) responding rapidly to changes in air temperature, are probably more representative of the actual fluctuating air temperatures, and differ from temperatures recorded by larger size (20-gauge) thermocouples or those recorded by usual means (thermograph) in an instrument shelter.

Quartermaster Research and Engineering Center, Natick, Mass.
THE SUMMER CLIMATE OF THE LAKE PETERS AREA, BROOKS RANGE, ALASKA, by Fernand de Percin. Interim rept. Nov 58, 11p. Research Study rept. RER-25.
Order from LC mi$2.40, ph$3.30 PB 150 765

This report released for sale to the public 26 Oct 60.

This report briefly describes the meteorological measurements made during summer 1958 in a little-known part of the Alaskan Arctic.

Travelers Insurance Co., Hartford, Conn.
SELECTING VARIATES FOR MULTIPLE DISCRIMINANT ANALYSIS WITH AN APPLICATION TO SHORT PERIOD FORECASTING OF AIRFIELD CEILING CONDITIONS, by Robert G. Miller. Final rept. for 1 Apr 58-31 Mar 60 on Contract AF 19(604)3878. July 60, 239p. 29 refs. AFCRC-TR-60-254.
Order from LC mi$10.20, ph$36.30 PB 152 050

A major portion of the work was devoted to the derivation of a statistical technique for selecting variates in discriminant analysis and the application of this technique to the problem of predicting ceiling conditions two hours in advance at McGuire Air Force Base. The entire analysis was directed towards ultimate applica-

tion of the technique and the results to problems of operational decision-making. A semi-technical summary of the more important concepts used in this study and a summary of the results of the ceiling experiment is included. (See also PB 143 579)

Geology

Heat Transfer Lab., Mass. Inst. of Tech., Cambridge.
AN ANALYSIS OF METHODS AND EQUIPMENTS FOR MEASURING HEAT FLOW THROUGH THE SOIL, by Richard J. Nickerson and Aydin Umur. Rept. on Contract DA 36-039-sc-78174. Feb 60, 22p. 10 refs. AD-237 049.
Order from LC mi$2.70, ph$4.80 PB 150 444

Consideration was given to measuring heat flow through soil by means of a heat flow meter and by means of a thermal conductivity probe. The heat flow meter consists of a thermal resistance across which the temperature difference is measured and used (with calibration) as an indication of the rate of heat flow. It is a steady state device and indications of heat flow are continuous. Objections to the heat meter were the interference of the meter with the normal moisture flow and the natural heat flow. Temperature distributions obtained by the relaxation method were used to describe several cases of the distortion of heat flow lines in a uniform medium caused by the presence of the heat meter. Numerical analysis indicated that distortion and considerable error occurred if too great an unbalance exists between meter and medium conductivity. The thermal conductivity probe is a transient device consisting of a cylindrical tube which contains a heater and temperature indicator. The thermal response of this device when buried in a large medium and subjected to a constant rate of heating can be used as an indication of the thermal conductivity of the surrounding medium. An analysis by Blackwell (J. Appl. Phys. 25, No. 2, 137-144, 1954) was given for a hollow probe buried in an infinite, uniform medium when heat was generated at the outer surface and temperature was measured at the inner surface.

Heat Transfer Lab., Mass. Inst. of Tech., Cambridge.
METHODS AND EQUIPMENT FOR MEASURING TEMPERATURE AND HEAT FLOW THROUGH THE SOIL, by Richard J. Nickerson and Aydin Umur. Final rept. on Contract DA 36-039-sc-78174. Jan 60, 24p. 6 refs. AD-237 116.
Order from LC mi$2.70, ph$4.80 PB 150 445

The design and construction of a thermal conductivity probe and a heat flow meter are discussed for measuring the heat flow and the temperature of soils. When determining heat flow with the thermal conductivity probe, the probe is buried in the soil and measurements of soil conductivity are made simultaneously with the local temperature gradient. The technique cannot be made continuous by recording in a simple fashion. The heat flow meter provides a heat flow resistance in the soil. With suitable calibration, a measurement of the temperature drop across the faces of the meter, which can be continuously recorded, provides a measurement of the heat flow through the meter. The most important requirement for the cylinder to be used for heat meter tests is that the flow within the cylinder be one-dimensional at a distance from the heat meter. The thermal conductivity probe was used in experiments on a clear plastic, a black silicone rubber insulating material, Kaylo (an insulation board), and Santocel (a powder). Serious discrepancies existed between the values of thermal conductivity obtained with this device and those determined by the Guarded Hot Plate tests for the plastic and rubber specimens.

Navy Electronics Lab., San Diego, Calif.
PHYSICAL LIMNOLOGY OF LAKE MEAD, by E. R. Anderson and D. W. Pritchard. Final rept. on Lake Mead Sedimentation Survey. [1951] 152p. 12 refs. Rept. 258.
Order from LC mi$7.50, ph$24.30 PB 152 643

This report released for sale to the public 7 Nov 60.

The general circulation and evaporation of Lake Mead, Nevada, were determined from data gathered during monthly survey cruises over the period February 1948 through February 1949. The circulations, based on salinity patterns, did not materially differ in the winters of 1948 and 1949, although the latter was much colder, and it is believed that the important features of the circulation for all seasons are repeated from year to year. The total annual evaporation, computed from a preliminary energy budget, was 161 cm, the monthly average being 13.4 cm as compared with a monthly average of 8.4 cm for the oceans. The work was done in conjunction with the U. S. Geological Survey and other government agencies cooperating in a limnologic and geologic survey of the lake. (Author)

Quartermaster Research and [Engineering] Center, Natick, Mass.
THREE MOUNTAIN AREAS IN SOUTHWESTERN WYOMING, by Max E. Morris and William C. Robison. Sep 55, 37p. 27 refs. Research Study rept. RER-6.
Order from LC mi$3.00, ph$6.30 PB 150 766

This report released for sale to the public 26 Oct 60.

The three mountain areas presented are: The Wind River Range; The Wyoming Salt River Range; and The Uinta Range. This report describes environmental conditions affecting military operations in the mountains.

Oceanography

Hydraulic Engineering Lab., U. of California, Berkeley.
SILT TRANSPORT STUDIES UTILIZING RADIOISOTOPES, by R. B. Krone. Annual progress rept. no. 1, Oct 56-Dec 57, on Contract DA 04-203-CIVENG-57-61. [1958] 125p. 99 refs.
Order from LC mi$6.30, ph$19.80 PB 152 645

This report released for sale to the public 7 Nov 60.

This research has been primarily concerned with the development of a means of measuring the movement of sediment. Conclusions regarding this method, as outlined in this report, can be summarized as follows: (1) The movement of sands has been satisfactorily traced using ground glass containing dissolved gamma emitting radioisotopes. (2) The physical properties of clayey sediments in salt water made inert particulate tracers unsatisfactory for tracing these sediments. (3) Simple sorption of gold-198 or scandium-46 on wet clayey sediments provides an inexpensive and convenient means of labeling these materials. (4) The ultimate elutable label depends on suspension concentration. (5) An underwater scintillation detector has satisfactory sensitivity for detecting small amounts of labeled sediment. (6) Because of the shielding properties of water for gamma particles the resolution of the detector for variations in tracer concentration is good. (7) The problems of underwater detection associated with unknown spatial distribution of radioactive material can be resolved by a vertical traverse of the activity, or for buried tracer, by core samples. (8) Successful quantitative application of the method requires foreknowledge of the qualitative sediment regimen in the problem area.

Scripps Institution of Oceanography, U. of California, San Diego.
MARINE MICROBIOLOGY, by Claude E. ZoBell. Final rept. for 1 July 50-31 Jan 60 on Effects of High Hydrostatic Pressure and Other Factors on the Distribution and Physiological Activities of Marine Bacteria, Contract Nonr-2216(00); Continuation of Contract N6onr-275(18). 31 Jan 60, 10p. 17 refs. SIO Ref. 60-14; AD-236 847.
Order from LC mi$1.80, ph$1.80 PB 147 175

Summary of results on: development of apparatus; some effects of high pressure on the viability of bacteria; effect of compression on bacterial morphology; mutagenesis induced by pressure; effect of compression on phosphate activity; pressure inhibits nitrate reduction; effect of pressure on succinic dehydrogenase; effect of pressure on urea-urease system; activity of an aspartase accelerated by pressure; studies on sulfate-reducing bacteria; denaturation of glycosidase by compression; adaptation of marine bacteria to increased pressures; heat of compression of aqueous systems; oxygen tension in compressed cultures; kinetics of bacterial growth; participation in oceanographic expeditions.

Texas A. and M. Coll., College Station.
AN ANALYTICAL SYSTEM FOR INTERPOLATION AND CALCULATION OF DYNAMIC HEIGHTS, by R. E. Kilmer and A. C. Duxbury. Technical rept. on Contract N7onr-487(02). Nov 59, 35p. 4 refs. Reference 59-24T; AD-232 880.
Order from LC mi$3.00, ph$6.30 PB 150 487

A data processing system was designed to provide a rapid procedure for the computation and evaluation of hydrographic data. This method is functional and accurate. Although the final depth cards do not correspond to the proposed international form (I. C. E. S.), (1958), they may easily be converted to this form for international use. The computer calculations are completely objective and any variations in the interpolated curves which do not meet the approval of the classical oceanographer may be changed at the discretion of the investigator. (Author)

Washington U., Seattle.
THE DYNAMICS OF A FIORD ESTUARY: SILVER BAY, ALASKA, by William Bruce McAlister, Maurice Rattray, Jr. and Clifford A. Barnes. Technical rept. no. 62 on Contracts Nonr-477(10) and 477(01). Nov 59, 77p. 14 refs. Reference 59-28; AD-230 537.
Order from LC mi$4.50, ph$12.30 PB 150 497

Observations of water properties and movements made in July 1956 and March 1957, are used to describe the dynamics involved in the circulation of waters in Silver Bay, Alaska. This is an estuary system of a type commonly found along the coasts of British Columbia and Alaska. The 2 seasons are representative of the extreme of summer and winter oceanographic conditions which occur in this locality. In a tidal estuary, the addition of fresh water by river runoff produces mass and velocity fields in accordance with the principles of fluid mechanics. While the equations describing the distribution of mass and velocity are not solved in general, the individual terms in the equations are evaluated for Silver Bay. With high runoff, and consequent large density gradients, results show that the pressure gradient, in the surface layers is largely balanced by the inertial terms. With the low runoff, the pressure gradient balances the vertical stress gradient. The salt balance of the estuary is maintained primarily by advective processes. (Author)

Washington U., Seattle.
PHYSICAL AND CHEMICAL DATA, NORTH PACIFIC OCEAN, by Richard H. Fleming. Special rept. no. 30 on Brown Bear Cruise 199, July-August 1958 for the International Geophysical Year of 1957-1958, Contract Nonr-477(10), National Science Foundation Grants Y/9.7/79 and Y/9.14/139. Mar 59, 211p. 10 refs. Ref. no. 58-32.
Order from LC mi$9.60, ph$33.30 PB 148 267

The major objectives were: (a) To reoccupy CARNEGIE Stations 126 through 132 to determine changes in the properties of the deep water during the 29-year interval since 1929 when these stations were last occupied. (b) To study the transition zone between Sub-Arctic and Subtropic Water masses in the Northeastern Pacific Ocean. In addition, a comprehensive program of oceanographic sampling was carried out along the cruise track. (See also PB 139 858)

Woods Hole Oceanographic Institution, Mass.
OCEANOGRAPHIC DATA FROM CRAWFORD CRUISE 22: TRANSATLANTIC SECTIONS AT EQUATOR AND 24° SOUTH FOR THE INTERNATIONAL GEOPHYSICAL YEAR OF 1957-1958, by W. G. Metcalf. Rept. on Contract Nonr-2196(00). Jan 60, 149p. Reference no. 60-3; AD-237 815.
Order from LC mi$7.20, ph$22.80 PB 148 125

Temperature, salinity and oxygen profiles are presented on a base showing observation points and bottom contours. The Depth of the observations has been

rounded off to the nearest five meters. Salinities were determined on the Woods Hole salinometer, Model 2, an improved version of the instrument described by Schleicher and Bradshaw (1956). Dissolved oxygen determinations were carried out by the Winkler method. The determinations of inorganic phosphorus, total phosphorus and chlorophyl were carried out. A detailed sounding track is presented.

Woods Hole Oceanographic Institution, Mass.
OCEANOGRAPHIC DATA FROM THE R. R. S. DISCOVERY II. INTERNATIONAL GEOPHYSICAL YEAR, CRUISE 3, 1958, by L. V. Worthington. Rept. on Contract Nonr-2196(00). Nov 59, 94p. 5 refs. Ref no. 59-54; AD-231 105.
Order from LC mi$5.40, ph$15.30 PB 150 529

Physics of the Atmosphere

Army Research and Development Lab., Fort Monmouth, N. J.
ON THE STRUCTURE OF THE UPPER IONOSPHERE, by Siegfried J. Bauer. 1 July 60, 27p. 24 refs. USASRDL Technical rept. 2131; AD-240 128.
Order from LC mi$2.70, ph$4.80 PB 150 452

Properties of ionospheric models are discussed with emphasis on the region above the F_2 peak and ionospheric parameters obtainable from moon radar, rocket, and satellite observations. Examples of electron-density profiles for ionospheric models assuming a scale-height gradient and height-dependent electron loss are presented in graphical form. The basic model for the electron density distribution in the ionosphere is the Chapman distribution, which was derived on the basis of equilibrium between electron-ion production by solar radiation and decay by height-independent recombination in an isothermal atmosphere. The scale-height structure of the upper atmosphere based on satellite data is briefly discussed. A modified Chapman distribution with a positive scale-height gradient is shown to be consistent with the electron-density profile above the F_2 peak obtained from recent rocket measurements.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PRELIMINARY ESTIMATES OF VARIABILITY OF WINDS IN THE LOWEST 500 FEET, by Raymond L. Bellucci. 15 June 60, 19p. 2 refs. USASRDL Technical rept. 2122; AD-241 176.
Order from LC mi$2.40, ph$3.30 PB 152 189

This report describes an experiment which was designed for the purpose of determining the time variation of the wind in the lowest 500 feet, using the double-theodolite wind set for obtaining winds. The results of the experiment led to equations describing the surface wind variability with time and wind speed at Belmar, New Jersey. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
SUMMARY REPORT ON BRL-IGY ACTIVITIES, by Spence T. Marks. Apr 60, 174p. 61 refs. Rept. no. 1104.
Order from LC mi$8.10, ph$27.30 PB 150 417

The historical background of the IGY is reviewed briefly. Activities in which BRL participated are described. A number of studies pertinent to IGY research are presented. BRL-IGY program summaries, and research results are given. These include: The Rocket Tracking Program, the Rocket Research Program, the Balloon Research Program, the Electron Density Program, and the Satellite Tracking Program. A bibliography of BRL-IGY reports, publications, and presented papers is also included. (Author)

Electronics Research Lab., Northeastern U., Boston, Mass.
RESEARCH DIRECTED TOWARD THE DEVELOPMENT OF PHOTO-OPTICAL, ELECTRONIC, AND CALIBRATION APPARATUS, by Louis J. Nardone. Final technical rept. on Contract AF 19(604)1749. 31 Mar 60, 56p. AFCRC TR-60-234; AD-234 043.
Order from LC mi$3.60, ph$9.30 PB 148 257

In support of the upper-air research program, activities conducted were primarily concerned with direct and indirect support of projects dealing with micrometeorite detection, measurement of day air-glow, and the installation of a data-reduction facility. A micrometeorite detection experiment launched from Holloman Air Force Base, New Mexico, failed to yield the desired information because the nose-cone tip failed to eject. An experiment was launched from White Sands Missile Range, New Mexico to obtain measurements pertaining to sky brightness and the theoretical enhancement of the 6300A oxygen line. Preliminary results indicated a sky brightness of less than 1.08×10^{-4} cd/ft^2 above 175,000 feet. Since no indication of the 6300A line was recorded, it was concluded that this line must have a strength of less than 0.5 kilorayleighs, the maximum sensitivity of the recording instrumentation. A data-reduction facility was established to handle data obtained primarily from fm-fm telemetry systems. An equipment development program to support the major activities include a magnetic beam-switching tube counter and an improved facsimile recorder to assist in data reduction. Described also are a telemetry subcarrier separator used with the five lowest standard telemetry channels, and a preliminary investigation conducted to determine the feasibility of constructing a rocket-borne, low-frequency, solar-noise receiver. (Author).

Lichtklimatisches Observatorium Arosa (Switzerland).
VERTICAL OZONE DISTRIBUTION OVER AROSA FROM THREE YEARS' ROUTINE OBSERVATION OF THE UMKEHR EFFECT, by Hans Ulrich Dütsch. Final rept. on Ozone and General Circulation in the Stratosphere, Contract AF 61(514)905. Sep 59, 57p. 8 refs. AFCRC-TR-59-290; AD-230 332.
Order from LC mi$3.60, ph$9.30 PB 152 056

Contents:
Observations
Extension of observations to very low sun heights

Calibration
Observations on cloudy sky
Evaluation of the vertical ozone distribution from Umkehr observations on wavelength pair C
Secondary scattering
Influence of temperature on absorption coefficients
Comparison with other methods
Results on vertical distribution
Seasonal variations of ozone concentration at different heights
Influence of large scale deviations from the normal circulation pattern
Some single ozone distributions connected with special weather situations
Vertical ozone distribution, single cases

Oklahoma State U. Research Foundation, Stillwater.
PROVIDE SERVICES TOWARD INSTRUMENTING AEROBEE ROCKETS, by Richard F. Buck. Final rept. on Contract AF 19(604)2029. 31 July 60, 63p. AFCRL TR-60-401.
Order from LC mi$3.90, ph$10.80 PB 150 873

A wide variety of support activities have been conducted which may be separated into two broad classes: (1) direct support in the form of man-power and equipment for bunch missions at the firing sites, where upper air research experimentation has been conducted through the use of rocket sounding vehicles and (2) indirect support activities, which have been concerned with activities in the Stillwater laboratory. These have provided the necessary equipment and facilities for these research instrumentation vehicles. (Author)

Stanford Research Inst., Menlo Park, Calif.
ATMOSPHERIC RADIATIVE HEATING AND COOLING, by K. L. Coulson. Scientific rept. no. 1 on Contract AF 19(604)5965. Mar 60, 40p. 44 refs. SRI Proj. 2994; ARPA Order no. 26-59; AFCRC TN-60-273; AD-234 972.
Order from LC mi$3.00, ph$6.30 PB 148 255

In an effort to develop a non-adiabatic atmospheric heating model for use in dynamical-numerical investigations, the various sources and sinks of radiative energy in the atmosphere are discussed. For this study, the atmosphere is divided vertically into 4 regions, each of which has a radiation regime peculiar to itself. The tropospheric radiation balance is controlled principally by water, either as vapor or as the liquid water of cloud droplets. Processes in the troposphere combine to cause a net radiative cooling of 1 or 2°C per day. The stratosphere, taken as the region from the tropopause upward to the base of the ozonosphere, is characterized by small radiative effects which combine to produce radiative quasi-equilibrium. The ozonosphere is heated by ozone absorption of solar radiation and cooled by long-wave emission from carbon dioxide and ozone. The maxima of both heating and cooling occur at a height of 45-50 km, and the magnitudes are both of the order of 5-10°C per day. Thus there is much cancelling of sources and sinks. The mesosphere, consisting of the region from about 55-60 km to the height of the temperature minimum at about 80 km, is generally considered to have only minor radiative temperature changes. It is suggested that if the probable increase of ozone concentration at night is taken into account, considerable cooling could result from the long-wave emission by ozone. Rapid photodissociation of the ozone after sunrise prevents much solar energy absorption during the day. (Author)

Upper Air Lab., U. of Colorado, Boulder.
RADIOMETER FOR HIGH ALTITUDE RADIATION MEASUREMENTS, by Edward P. Todd and Frank E. Stuart. Final rept. on Contract AF 19(604)1899. [1960] 84p. 16 refs. GRD TR-60-286.
Order from LC mi$4.80, ph$13.80 PB 150 753

A history of the development of the miniature radiometer for satellite use is given with a more detailed description of the units. The solar constant radiometer is also discussed. Prior to the development of these radiometers three radiometers, incorporating various design features whose performance it was desired to test, were built and flown in a series of four balloon flights. These flights are described.

Willow Run Labs., U. of Michigan, Ann Arbor.
ANALYSIS OF A FALLING-SPHERE EXPERIMENT FOR MEASUREMENT OF UPPER-ATMOSPHERE DENSITY AND WIND VELOCITY, by J. Otterman, I. J. Sattinger and D. F. Smith. Rept. on Contract AF 19(604)5205. Apr 60, 58p. 18 refs. Rept. no. 2873-5-F; AFCRC-TR-60-218.
Order from LC mi$3.60, ph$9.30 PB 150 421

A method is described by which upper-air density and wind velocity can be determined by measuring the drag acceleration of a falling sphere by means of accelerometers mounted on an inertial platform carried within the sphere. An investigation was made to determine the size, weight, and accuracy of available inertial platforms. An analysis based on this information shows that air density and wind velocity can be measured by this method up to altitudes of at least 150 km and 120 km, respectively. The error in air-density measurement would be 20% or less, and the wind-velocity error would be 10 m/sec or less. Some of the major considerations in the design of the system are discussed, particularly those involved in the selection or design of the rocket, inflatable sphere, and inertial-platform system. (Author) (See also PB 147 762)

ENGINEERING

Aeronautical Engineering

Aeronautical Engine Lab., Naval Air Material Center, Philadelphia, Pa.
DEVELOPMENT OF TURBO-JET ENGINE THRUST DESTROYING AND REVERSING NOZZLE NO. AEL 102, by I. P. Polak. Rept. on Proj. TED no. NAM-PP-375 and TED no. NAM-04614. [13 jan 50] 101p. 9 refs. AEL-1108.
Order from LC mi$5.70, ph$16.80 PB 152 641

This report released for sale to the public 10 Nov 60.

The results of ground and flight tests conducted with the nozzle installed on FR-1 airplanes indicate that the use of the nozzle to provide rapid variation of thrust is a substantial improvement over control by throttle. The improvement is especially noticeable in operations such as: (a) reducing speed immediately after a cut on a carrier-landing approach (b) reducing the landing run of non-carrier airplanes (c) increasing speed immediately after a wave-off on a carrier landing approach. The results of flight tests with the nozzle installed on

a FR-1 airplane also indicated that this aircraft's stability and trim were critically altered by partial and reverse thrust nozzle operation. Nozzle installation effects on the aircraft's lift and drag were negligible. (Author)

Aerospace Medical Div., Wright Air Development Div., Wright-Patterson AFB, Ohio.
USAGE RATES OF AIRCRAFT OXYGEN, by Margaret M. Jackson. Rept. on Physiology of Flight Proj. May 60, 20p. 13 refs. WADD Technical rept. 60-106.
Order from OTS $0.50 PB 171 087

An investigation was conducted to evaluate aircrew oxygen requirements for current and future aircraft. A literature review of studies on the rate of oxygen use in flight is presented. Data from actual flights, altitude chamber studies, and simulated missions on a jet trainer and F-102 simulator with subjects wearing full-head pressure helmets or oxygen masks is presented and discussed. Results of the investigation indicate that aircraft oxygen installation figures, when based on a pulmonary ventilation rate of 25 l./min. BTPS, will provide an adequate oxygen supply for 99 percent of the Air Force personnel performing duties equivalent to light work at cabin altitudes up to 35,000 feet. Loss of cabin pressure with subsequent exposure to higher altitudes increases the requirement for oxygen. (Author)

Air Force Flight Test Center, Edwards AFB, Calif.
SA-16B LIMITED PHASE IV STABILITY CONTROL AND PERFORMANCE, by Charles C. Crawford and Tommie D. Benefield. Oct 57, 90p. AFFTC-TR-57-16; AD-124 114.
Order from LC mi$4.80, ph$13.80 PB 152 296

This report released for sale to the public 27 Oct 60.

For comparable fuel loads, the SA-16B overall performance is superior to that of the SA-16A. The single engine capability of the B model indicates a considerable improvement over the A model. The single engine service ceiling of the SA-16A for a gross weight of 32,000 pounds is sea level while the SA-16B's single engine service ceiling is 4,300 feet for a climb start gross weight of 33,500 pounds. Comparison of the basic radius mission of these aircraft shows the SA-16B has a radius of 805 nautical miles as compared to a radius of 699 nautical miles for the SA-16A, based on equal fuel loadings of 7425 pounds of fuel. The stability, control and handling characteristics of the SA-16B are acceptable. (Author).

Army Transportation Research Command, Fort Eustis, Va.
PROCEEDINGS OF A NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) BRIEFING ON AIRCRAFT RESEARCH. Rept. on a Technical Review of VTOL/STOL Principles That May Be Applied to U. S. Army Requirements. 15 Dec 59, 102p. 475 refs.
Order from LC mi$5.70, ep$18.30 PB 152 752

This report released for sale to the public 17 Nov 60.

Contents:
General performance characteristics of VTOL/STOL aircraft, by Richard E. Kuhn and Marion O. McKinney, Jr.
Stability and control of VTOL/STOL aircraft, by Robert O. Schade, Robert J. Tapscott, and Woodrow L. Cook
Limited flight experience with several types of VTOL aircraft, by John P. Reeder and Fred J. Drinkwater, III.

Arnold Engineering Development Center [Tullahoma, Tenn].
AN INVESTIGATION OF EJECTORS WITHOUT INDUCED FLOW, PHASE I, by D. L. Barton and D. Taylor. Rept. on ARO, Inc., Contract AF 40(600)800. Dec 59, 42p. 4 refs. AEDC TN-59-145.
Order from LC mi$3.30, ph$7.80 PB 152 647

This report released for sale to the public 10 Nov 60.

An investigation was conducted to determine the effects of nozzle area ratio and nozzle throat to diffuser area ratio on performance of ejectors without induced flow. Five nozzles having constant exit diameters and different throat diameters were tested in three diffusers having different diameters. All nozzles had conical contours with a 36-deg total efflux angle, and all diffusers had length to diameter ratios of 3.0. Test cell pressure, ejector nozzle driving pressure, exhaust pressure, and diffuser static pressure profiles were measured. Data from all configurations were analyzed to determine the effects of ejector geometry on performance. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn].
PRESSURE DISTRIBUTION TESTS OF SEVERAL SHARP LEADING EDGE WINGS, BODIES AND BODY-WING COMBINATIONS AT MACH 5 AND 8, by R. E. Randall, D. R. Bell, and J. L. Burk. Rept. on ARO, Inc. Contract AF 40(600)800 S/A 11(60-110). Sep 60, 60p. 2 refs. AEDC-TN-60-173.
Order from LC mi$3.60, ph$9.30 PB 150 985

Pressure distribution data were obtained on several sharp leading edge wings, conical bodies, and body-wing combinations at Mach 5 and 8. The unit Reynolds number was varied from 0.8×10^6 to 6×10^6 per foot to determine the effect on the pressure distribution. The angle-of-attack range was from -10 to +20 deg. Shadowgraphs of shock wave and boundary layer phenomena were obtained at various angles of attack. Vapor screen photographs were taken with liquefied flow conditions in the test section to visualize the cross-sectional shape of the shock wave. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
CENTRIFUGE SIMULATION OF THE X-15 RESEARCH AIRCRAFT, by Carl C. Clark and C. H. Woodling (National Aeronautics and Space Administration). Rept. no. 9 on Proj. MR 005.12-0005.4 and Proj. NM 11 02 12.4. 10 Dec 59, 36p. 17 refs. NADC-MA-5916; AD-233 340.
Order from LC mi$3.00, ph$6.30 PB 148 274

Three X-15 centrifuge programs were conducted. The first program involved 168 runs under cam control, with the subject receiving accelerations predicted for the X-15 as if he were a passenger. For the other two programs, the newly developed technique of pilot-computer "closed-loop" control of the centrifuge, or centrifuge dynamic control flight simulation, was utilized with the pilot receiving accelerations computed for the X-15 under his own control while he carried out the assigned flight mission, involving re-entries at various angles of attack and peak normal loads with and without speed brakes, and with or without control augmentation (dampers). During these two programs, 991 "static" flights (centrifuge at rest) and 433 "dynamic" flights (centrifuge in motion) were made on the centrifuge simulator. Pilots who were properly fitted into the seat and restraints; had at least 10 hours of static simulator practice; and had previous high acceleration experience could control the X-15 centrifuge simulator through parts of the design missions (computed aircraft speeds greater than Mach 2) while receiving the accelerations greater than 1 G continuously computed in magnitude and direction as a consequence of their control and used as centrifuge drive signals. Pilots who did not meet these specifications did notably less well dynamically than statically, a consequence attributed to their incorrect control responses while under acceleration or to their less rapid detection of and correction for the involuntary pilot inputs produced by the flight loads. (Author).

Bolt, Beranek and Newman, Inc., Cambridge, Mass.
FIELD MEASUREMENT OF COMMUNITY NOISE EXPOSURE NEAR HANSCOM AIR FORCE BASE, MASS., by A. C. Pietrasanta. Rept. on Investigation and Control of the Acoustic Characteristics of Air Force Noise Sources, Contract AF 33(616)3938. Aug 58, 28p. 1 ref. WADC Technical note 58-163; AD-155 879.
Order from OTS $0.75 PB 171 076

The noise exposure at a location near Hanscom Field was measured for an eight-hour period by recording the noise levels from all aircraft flyovers during this period. The measured noise exposure, in terms of the equivalent continuous sound pressure level in the 300-600 cps band (L_{eq}) was found to be 74 db. It is compared with several calculated values of L_{eq} which differ depending on whether assumed or actual flight paths, flight profiles, or activity data were used. For assumed values for each of these three items, the calculated L_{eq} is 79 db. For the observed flight path, flight profile, and aircraft activity, the calculated and measured L_{eq}'s are in agreement. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
BALLOON FOR SOFT IMPACT LANDING, by H. D. Curchack and R. E. Van Der Linden. 29 Aug 60, 19p. TR-863.
Order from LC mi$2.40, ph$3.30 PB 152 315

The top of a balloon striking a flat rigid surface would be cushioned by the gas within the balloon, and the feasibility of using this effect to cushion a load in high-velocity impacts was investigated. A one-dimensional analysis of the impact was made assuming that the balloon is of moderate dimensions (from 3 to 30 ft in diameter), that the impact velocity is either the moon escape velocity or 500 fps, and that the only force decelerating the top of the balloon is supplied by gas within it. Results indicate the system is not feasible for impact velocities as high as the moon escape velocity, but that the system may be feasible if the impact velocity is reduced through use of retrograde rockets to about 500 fps. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
PRELIMINARY STUDY OF POWER SUPPLIES FOR PNEUMATIC SYSTEMS, by D. J. Grant, A. Krasnick, and S. Katz. 30 June 60, 50p. 10 refs. TR-847.
Order from LC mi$3.30, ph$7.80 PB 152 313

A preliminary study was made of power supplies for pure pneumatic systems including a survey of several representative methods of supplying gas for pneumatic system elements; consideration of the thermodynamic relationships pertinent to their design; and a comparison of representative power supplies on the basis of weight, size, and estimated cost for specific pressure and mass flow requirements. Other factors considered in the study are handling problems, reliability, safety, and container shape. Packaged power supplies, such as gas generators and compressed gas bottles, are recommended for further study. (Author)

Federal Aviation Agency, Atlantic City, N. J.
A STUDY OF HELICOPTER PILOT'S EYE MOVEMENTS DURING VISUAL FLIGHT CONDITIONS, by James A. Sunkes and Eugene E. Pazera. Final rept. Nov 59, 110p. 5 refs.
Order from OTS $2.50 PB 171 094

Tests were conducted using three different types of Army helicopters, the Bell H-13, the Vertol H-21, and the Sikorsky H-34, to determine those areas of the windshield which the pilot actually uses most often during various maneuvers encountered in flight. The results were then used to further establish minimum cockpit visibility requirements for helicopters. (Author)

Flight Control Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
PROBABILITY OF ATTAINING A GIVEN FLIGHT PATH AS A FUNCTION OF THE TURN RADIUS, TURN INITIATION ERROR, AND HEADING CHANGE, by Eugene M. Romer. Aug 60, 13p. WADD Technical note 60-200.
Order from OTS $0.50 PB 171 116

The problem of changing aircraft heading to coincide with a particular ground track is considered. A probability function is derived which gives the probability of arriving within a corridor of specified width to either side of the desired flight path. This probability function is assumed to be a function only of the error in ascertaining the correct point at which to initiate the turn, the error in attaining a specified radius of curvature and the change in heading. Two forms of the probability function are obtained and an illustrative example for a particular case is worked out. (Author)

Flight Safety Foundation, Inc., Pheonix, Ariz.
AVIATION CRASH INJURY RESEARCH, by Ruth M. Petry. Final rept. for 1 Oct 55-15 Sep 59 on Contracts Nonr-401(21) and Nonr-2883(00). 11 Jan 60, 15p. 44 refs; AD-234 030.
Order from LC mi$2.40, ph$3.30 PB 148 870

A brief summary of work to provide data which can be used to improve crash survival design of aircraft, thereby increasing the survival rate in many aircraft accidents.

Hiller Aircraft Corp., Palo Alto, Calif.
COMPARATIVE PERFORMANCE CHARTS FOR DUCTED PROPELLERS. Rept. on Contract DA 44-177-TC-616. Mar 60, 100p. 38 refs. Rept. no. ARD-257; AD-241 376.
Order from LC mi$5.40, ph$15.30 PB 150 783

The purpose of this report is (1) to prepare general comparative charts insofar as possible from available experimental and theoretical information, (2) to conduct two-dimensional water experiments to obtain visual data of the ducted propeller wake, and (3) to conduct a limited theoretical study of the duct and wake shape in the static condition. The study is divided into three types of flow: static operation, non-axial flow and axial flow. The data are reduced to coefficient form and combined with appropriate correlation parameters and plotted. Several useful performance charts are constructed in the different flow regimes. The water test results are shown photographically, but are not conclusive due to test limitations. The theoretical duct shape and wake results are presented graphically. The wake shape from the water test and theory are essentially in agreement, but due to the water test limitations cannot be considered a valid check. (Author)

Institute of Transportation and Traffic Engineering, U. of California, Berkeley.
A MATHEMATICAL MODEL FOR LOCATING EXIT TAXIWAYS, by R. Horonjeff, R. C. Grassi and others. Rept. on Contract FAA/BRD-4. Dec 59, 52p. 4 refs.
Order from OTS $1.50 PB 171 068

The purpose of the present project was to formulate and test a mathematical model for determining the exit locations that will enable the runway to accept the greatest number of aircraft per hour within specified limits of percent wave-offs. The model can also be used to compute, for an existing airport where runways are already fixed, the average acceptance rates and percent wave-offs for various conditions. A mathematical model was developed for a single runway used exclusively for landing. The model makes it possible to determine the taxiway locations that will yield the highest runway acceptance rates, and corresponding wave-off rates, taking into account: (1) number of exits, (2) exit speed, (3) aircraft arrival rates at runway threshold, (4) aircraft population (i. e., a specified mixture of aircraft types), (5) pilot variability, and (6) meteorological and geographical conditions. The results show that the optimum locations and the corresponding average acceptance rates are quite sensitive to aircraft population, exit speed, and number of exits. Furthermore, if the number of exits and intervals of time between aircraft arriving over threshold are fixed, the optimum locations of the exits vary considerably for each aircraft population. (See also PB 151 162).

Minnesota U., Minneapolis.
INFLUENCE OF NATURAL FREQUENCIES AND SOURCE CORRELATION FIELDS ON RANDOM RESPONSE OF PANELS, by R. F. Lambert and D. H. Tack. Rept for Sep 58-Oct 59 on Metallic Materials, Contract AF 33(616)6828. July 60, 74p. 7 refs. WADD Technical rept. 60-188.
Order from OTS $2.00 PB 171 090

Theoretical and experimental analysis of random response of panels with a view toward problems of design are presented. The influence of source correlation fields, damping, and boundary impedance are integrated into the analysis. Modal response is viewed from the complex frequency plane in the form of a pole diagram. The concepts developed from this point of view have direct application in design for specified mean square response. The statistical independence of modes and its relationship to properties of the source and panel are discussed and interpreted for several situations. (Author)

Motorola, Inc., Riverside, Calif.
MEASUREMENT OF ATMOSPHERIC TRANSMISSION USING BACKSCATTER FROM A PULSED LIGHT SEPARATED SYSTEM, by Melvin H. Horman. Final rept. part 1, on Contract [AF] 19(604)2213. June 59, 112p. 9 refs. Rept. no. RLF-3828-3; AFCRC-TR-59-255; AD-217 614.
Order from LC mi$6.00, ph$18.30 PB 152 350

This report released for sale to the public 1 Nov 60.

A pulsed light transmissometer has been tested by comparing its measurements with those of a telephotometer and with visual range taken from an aircraft. The results indicate that the pulsed light transmissometer is a useful instrument for determining the transmission loss up a slant path, such as the glide path at an airport. This measurement can be made without affecting landing aircraft. A logarithmic amplifier, discussed in a separate report, was developed to simplify and decrease the time of the data reducing technique. The theory of the separated pulsed light transmissometer has been further developed and a nomogram drawn to facilitate data reduction. The processes of data reduction have been simplified to the point at which automatic computation is feasible. System limitations, secondary scatter, and ambient light level are discussed. A method for simpler data reduction is discussed. (Author)

National Aviation Facilities Experimental Center, Atlantic City, N. J.
EVALUATION OF A FLAME SURVEILLANCE-TYPE DETECTOR, by Marvin F. Rammelsburg and Paul R. Diefdorf. Apr 60, 28p.
Order from OTS $0.75 PB 171 028

A surveillance-type flame detector system of the Pyrotector design was evaluated in laboratory bench-type tests and by exposing the units to more than 250 small-magnitude JP-4 test fires in a modified KC-135 nacelle which had a comparatively low internal airflow.

Laboratory bench testing showed the detector's sensitivity decreased as the ambient light increased. In the KC-135 powerplant tests, the system detected 93 per cent of all the fires to which it was exposed. It functioned satisfactorily under several engine power conditions and had a consistently short response time. (Author)

National Aviation Facilities Experimental Center, Atlantic City, N. J.
PROGRAMMING IBM 650 RAMAC COMPUTER FOR DATA PROCESSING IN AN AIR ROUTE TRAFFIC CONTROL CENTER, by Harold R. Johnson, Jr. Juel E. Erickson and others. Oct 59, 105p. 2 refs.
Order from OTS $2.50 PB 171 040

This report describes the development and preparation of a detailed ATC program for an IBM-650/RAMAC computer system. Many portions of this program are predicated on the ability of this system to process all of the many types of flight plan information, to produce flight progress strips, and furnish other information needed for the control of air traffic at the Indianapolis Air Route Traffic Control Center. A description is given of the types and quantities of flight plans which must be processed. A general discussion of the program logic used for processing airway and/or direct route flight plans is included and is illustrated by charts, flow-diagrams, and pictures.

Naval Ordnance Test Station, China Lake, Calif.
ON HARMONIC MOTION OF WIDE DELTA AIRFOILS AT SUPERSONIC SPEEDS, by John W. Miles. 13 June 50, 47p. 8 refs. NAVORD rept. 1234; NOTS 294.
Order from LC mi$3.30, ph$7.80 PB 152 352

This report released for sale to the public 28 Oct 60.

The forces and moments acting on a generalized, oscillating, delta wing, bounded by two supersonic leading edges and a straight trailing edge perpendicular to the free stream, are formulated in such a way as to reduce their calculation to an equivalent, two-dimensional problem. Explicit results are given for the lift and pitching moments on a delta wing due to plunging and pitching, the damping moment in roll, and the lift, pitching, and rolling moments due to control-surface deflections. Numerical results are given in the form of curves. (Author)

Physics Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
ANALYSIS OF RELATIVE PERFORMANCE OF ABLATING MATERIALS COMPARED TO A HEAT SINK MATERIAL, by R. E. Otto. Rept. for Aug 58-Sep 59 on Materials Analysis and Evaluation Techniques. June 60, 13p. 2 refs. WADD Technical note 60-88.
Order from OTS $0.50 PB 171 054

Data are presented comparing relative performance of ablating materials with heat sink materials in terms of inside surface temperature rise and on a weight per unit area basis. Structural characteristics of available materials and analysis of re-entry deceleration loads are indicated. (Author).

Chemical Engineering

Army Chemical Research and Development Labs., Army Chemical Center, Md.
A PRELIMINARY THEORETICAL STUDY OF THE CLOUD TRAVEL OF AEROSOL PARTICLES HAVING DIAMETERS BETWEEN 20 AND 180 MICRONS, by Donald O. Egner, Donald Campbell and others. July 60, 88p. 7 refs. CRDLR-3002.
Order from LC mi$4.80, ph$13.80 PB 150 663

Several aerosol models have been reviewed for their ability to predict the travel of an aerosol cloud. The model of Baron, Gerhard, and Johnstone appears to be the most promising since it allows treatment of cases where settling velocities are appreciable. This model is evaluated for various conditions of wind speed, dissemination height, atmospheric stability, and terrain roughness. Several relationships are derived that facilitate the evaluation and application of the model. Basic curves and tables are established for use in describing contamination-density fields and corresponding density-area relationships. (Author)

Army Chemical Research and Development Labs., Army Chemical Center, Md.
SHOPAIR (SHORT-PATH INFRARED) TOXIC-AGENT DETECTION AND CONCENTRATION-MEASURING DEVICE, by Hugh R. Carlon, Robert E. Hagman and Harvey Tannenbaum. July 60, 20p. 2 refs. Technical rept. CRDLR 3006.
Order from LC mi$2.40, ph$3.30 PB 150 101

A SHOPAIR (Short-Path Infrared) instrument has been constructed and evaluated in the detection and monitoring of nerve-gas concentrations. Sensitivities of 2γ/liter (20-in. path) or better are obtained, with alarm occuring within a few seconds. The instrument has one moving part. Applications are suggested. (Author)

Battelle Memorial Inst., Columbus, Ohio.
A STUDY AND DEVELOPMENT OF THE HICKMAN SEA-WATER STILL, by W. L. Buckel, W. D. Beck and others. Rept. on Contract no. 14-01-001-104. Sep 60, 152p. 9 refs. Saline Water Research and Development Progress rept. no. 43.
Order from OTS $3.00 PB 171 030

The fundamental studies were especially necessary because evaporation and condensation on a rotating heat-transfer surface is a new art; it was particularly desirable to determine (1) the conditions under which rotating disks could be wetted with the thinnest possible films, and (2) the maximum heat-transfer coefficients that could be obtained with rotating disks. As a corollary of this study, the factors governing the economic potential of the distillation process have been reasonably well defined.

Marine Lab., U. of Miami [Coral Gables] Fla.
ANTIFOULING PROPERTIES OF PESTICIDAL MATERIALS, by Sigmund Miller. Monthly progress rept. for 1-30 June 59, on Contract NOa(s) 59-6182-c. June 59, 8p. ML 59160.
Order from LC mi$1.80, ph$1.80 PB 150 769

Panels impregnated with the chemicals are exposed in the sea in racks which hold 18 test panels and one non-toxic control panel (all of porous carbon). The group of 19 panels are inspected three times, after intervals of approximately ten days each, depending upon the intensity of fouling at the time of test. Fouling present is recorded, and each group of panels is photographed at the time of the second inspection. The effectiveness of the chemicals is listed in descending order of effectiveness. (See also PB 150 768).

Syracuse U. Research Inst., N. Y.
THE PROPERTIES OF GAS HYDRATES AND THEIR USE IN DEMINERALIZING SEA WATER, by Allen J. Barduhn, Howard E. Towlson, and Yee-Chien Hu. Rept. on Contract no. 14-01-001-177. Sep 60, 74p. 39 refs. Saline Water Research and Development Progress rept. no. 44.
Order from OTS $2.00 PB 171 031

This research was undertaken to study the properties of hydrates systems by collecting data from the literature and our own experimental work on pressures and temperatures at which various hydrates form and by determining the other thermodynamic properties of these systems such as heats of formation, composition, and effects of dissolved salt. The purpose was to get information necessary for process calculations and design, so that a choice of hydrating agent and an accurate evaluation of the hydrate process for demineralization could be made. (Author)

Civil Engineering

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
SOIL STABILIZATION: INVESTIGATIONS OF A CHEMICALLY MODIFIED CEMENT AS A STABILIZING MATERIAL, by G. R. Kozan. Rept. for Feb-Sep 58 on Solidifying or Stabilizing Soils for Military Operations. July 60, 60p. Technical rept. no. 3-455, rept. 3; AD-241 536.
Order from OTS $1.50 PB 171 098

Laboratory and field tests were made to (a) determine effectiveness of chemically modified cement as a stabilizing material for a lean clay soil, and (b) establish validity of strength requirements proposed for a stabilized soil surface to be used for short-term military operations. Initial laboratory tests revealed that 5% portland cement-1% sodium sulfate was as effective after 24-hr curing as 10% portland cement (unmodified). However, supplementary laboratory tests conducted concurrently with field tests indicated sulfate modification to be essentially ineffective for the test section soil because the soil differed in chemical characteristics from the soil used in the initial tests. A soil surface stabilized with 5% cement-1% sodium sulfate, constructed on a 4 CBR subgrade, developed sufficient strength within one day to meet specified traffic requirements, primarily due to stabilizing action of the cement. (Author)

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
VALIDATION OF SOIL-STRENGTH CRITERIA FOR AIRCRAFT OPERATIONS ON UNPREPARED LANDING STRIPS, by C. D. Burns. Rept. on Criteria for Designing Runways Surfaced with Landing Mat and Membrane-Type Materials. July 60, 43p. 3 refs. Technical rept. no. 3-554; AD-241 546.
Order from LC mi$3.30, ph$7.80 PB 150 436

To validate Corps of Engineers tentative soil-strength criteria for aircraft operations on unsurfaced soils, which are based on CBR values, WES participated in aircraft operational tests on unprepared sandy soil sites. The C-123B, a single-wheel transport, and the C-130A, a multiple-wheel transport, with gross loads of 38,000-48,000 lb and 80,000-116,000 lb, and main gear pressures of 41-90 psi and from 55-60 psi, respectively, were used. Soil-strength measurements were obtained before and during the tests. Conclusions were that: (a) both planes can operate successfully on sand surfaces having 4- to 6-in.-deep ruts; (b) the average soil strength of the 6- through 12-in. depths can be used to evaluate load-carrying capacity of sand subgrades; (c) increasing wheel loads at constant tire pressures has little effect on rut depths, but increasing tire pressure at constant or increasing wheel loads causes more severe rutting; (d) minimum subgrade strength requirements determined in these tests agreed with those indicated by previously developed CBR design curves; and (e) the CE tentative strength criteria are as good as can be established from available data. (Author)

Michigan U. [Research Inst.] Ann Arbor.
STRUCTURAL STEEL CONNECTIONS, by Leo Schenker, Charles G. Salmon and Bruce G. Johnston. Rept. on Contract NOy-74521. June 54, 227p. 112 refs. 2065-1-F; AFSWP rept. no. 352.
Order from LC mi$9.90, ph$34.80 PB 152 355

This report released for sale to the public 28 Oct 60.

The report covers only one aspect of the problem of structural behavior, but is an attempt to provide a reasonably thorough and usable evaluation and summary of available information in the field of structural connections. The properties of the actual connectors (rivets, bolts, welds, etc.) are discussed in Chapter I. Chapter II deals with tension connections. In Chapters III and IV the characteristics of rigid and nonrigid connections as used in continuous frames and tier buildings are studied and their effect on the analysis and design procedures for building frames is investigated. The influence of column anchorages on the resistance of buildings to lateral loads is discussed in Chapter V. Very little experimental information on this problem is available so that the discussion here is primarily on a theoretical basis. Chapter VI presents some examples illustrating the procedures that would make use of the information in the previous chapters.

Electrical and Electronic Engineering

Airborne Instruments Lab., Mineola, N. Y.
DEVELOPMENT OF A MICROWAVE PRESELECTOR, by R. Sieven. Final rept. on Contract DA 36-039-sc-73160. June 58, 57p. 12 refs. Rept. no. 4600-1; AD-208 579.
Order from LC mi$3.60, ph$9.30 PB 150 681

Two microwave preselectors have been designed and fabricated for operation over the 7125 to 8500 Mc band. Each unit consists of a gang-tuned four-element filter, a STRIPLINE balanced mixer, and an i-f preamplifier. Two i-f amplifiers were provided to permit evaluation of the systems. The overall performance of the system is best evaluated by measuring the noise figures at several frequencies in the 7125 to 8500 Mc band. The noise figures for system 1 varied from less than 14 db at the band edges to a minimum of 9.8 db. The noise figures for system 2 varied from less than 12 db at the band edges to a minimum of 9.6 db. The superior performance of system 2 was attained because of the experience gained in the development and fabrication of system 1. (Author)

Airborne Instruments Lab., Melville, N. Y.
EVALUATION OF AIR TRAFFIC CONTROL RADAR-BEACON SYSTEMS (ATCRBS), by M. Natchipolsky, J. S. Perry and others. Final engineering rept. Phase 2, Oct 58-July 59, on Contracts FAA/BRD 119 and 84; formerly C13 ca 608 and 681. Oct 59, 285p. 2 refs. Rept. no. 7356-1, Vols. 1 and 2.
Order from OTS $4.00 PB 171 095

To evaluate the operational and technical characteristics of the ATCRBS, an in-service test program was conducted in the New York terminal area. The program tested and evaluated the ATCRBS installations at the New York Air Route Traffic Control Center, Idlewild Tower, LaGuardia Tower, and Newark Tower. During these tests, ATCRBS performance proved superior to that of the primary radar. Several ATCRBS operational procedures were tested and evaluated to determine their contribution ot the immediate improvement and future automation of air traffic control. Military-civil high-density ground and air environments were used to determine system behavior for the planned ATCRBS installation in the New York terminal area. The pulse interference generated by the system was reduced by the fix-equipments (remedial equipment) tested. Single defruiting effectively cleaned the displays of fruit under all test conditions. A side-lobe-suppression system was tested; it proved effective in preventing side-lobe interrogations and thus in reducing transponder reply duty cycle. ATCRBS operations procedures were tested and found to improve the effectiveness of the present ATC system. The immediate implementation of the ATCRBS and the simultaneous development of a test program to achieve maximum operational usefulness of the system is recommended. (Author)

American Inst. for Research, Pittsburgh, Pa.
SIMULTANEOUS VS. SUCCESSIVE PRESENTATION OF RELATIVE MOTION PROBLEMS, by M. Paul Willis and Frank Siroky. Rept. on Contract N61339-348. 26 Aug 60, 77p. 11 refs. Technical rept. NAVTRADEVCEN 348-2.
Order from LC mi$4.50, ph$12.30 PB 150 160

This study tested the hypothesis that the development of understanding of relative motion concepts will be facilitated by simultaneous presentation of three relevant reference systems. Twenty-one high school graduates attending an electronic technical institute were randomly assigned to three experimental conditions based on the simultaneity variable, namely, successive, intermediate simultaneity and maximum simultaneity of presentation of reference systems. The apparatus consisted of two movable, transparent polar coordinates and one fixed rectangular grid, which permitted subjects to superimpose all three solutions. Printed instructions and self-teaching procedures were used exclusively. An analysis of variance statistical technique was used on the data. The findings showed that simultaneous methods of reference system presentation are not superior to successive presentation over all problem types and all reference systems. However, the simultaneous methods are superior on certain specific combinations of factors, particularly for closest point of approach and intercept problems. (Author)

Antenna Lab., Ohio State U. Research Foundation, Columbus.
ECHO AREA OF COMBINATIONS OF CONES, SPHEROIDS, AND HEMISPHERES AS A FUNCTION OF BISTATIC ANGLE AND TARGET ASPECT, by J. W. Eberle and R. W. St. Clair. Rept. on Contract AF 19(604)6157. 30 June 60, 39p. 1 ref. Rept. 1073-1; ERD-TN-60-795.
Order from LC mi$3.00, ph$6.30. PB 150 740

The scattering cross section of various combinations of cones, spheroids, and hemispheres is presented as a function of bistatic angle and target aspect. All measurements were taken at a frequency of 9375 mc (3.2 cm wavelength). A description of the equipment used for the measurements is given along with the method used to calibrate the patterns. A technique is described which permits the phase of a scattered signal to be determined with respect to a fixed reference signal. A typical amplitude and phase pattern for a bihemisphere combination is shown. (Author).

Armour Research Foundation, Chicago, Ill.
HIGH POWER TRANSDUCERS, BY H. B. Karplus and R. R. Whymark. Quarterly rept. no. 2 on Contract [Nonr] 2900(00). 22 Dec 59, 4p. ARF 1149-2.
Order from LC mi$1.80, ph$1.80 PB 152 140

See also PB 149 877.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE DESIGN AND FABRICATION OF HF AND VHF LOW PASS FILTERS FOR A HIGH POWER TRANSMITTER, by Walter Grudus and Alan Budner. 1 July 60, 58p. 2 refs. USASRDL Technical rept. 2132; AD-240 615.
Order from LC mi$3.60, ph$9.30 PB 152 191

The report presents the development of a series of 11 low-pass filters capable of handling at least 500 watts, where the cut-off frequency varied from 8.33 mc to 267 mc. Maximum insertions loss was 0.5 db up to 0.85 f_c and the minimum attenuation was 50 db above 1.25 f_c.

The impedance level was 50 ohms with a VSWR of 1.5 to 1 up to 0.9 f_c. The construction of these filters is completely explained with all data required for fabrication furnished. Characteristics of the first set appear in the Appendix. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
MULTIPLE BEAM ANTENNA SYSTEM, by William Fishbein. 15 Apr 60, 16p. USASRDL Technical rept. 2112; AD-238 426.
Order from LC mi$2.40, ph$3.30 PB 152 188

An antenna aperture must be many wavelengths long to obtain high angular resolution. In conventional antennas, radiators are spaced about one-half wavelength apart of avoid multiple lobes. USASRDL engineers constructed an antenna consisting of 10 radiators spaced 30 wavelengths apart. Two techniques investigated circumvent the multiple lobe problem caused by the large radiator spacing. These techniques are based on the use of separate antennas for transmitting and receiving. The first technique involves the use of a receiving antenna with a single beam narrow enough to select only one of the multiple lobes of the transmitting antenna. The second technique uses 2 multiple beam antennas with slightly different lobe spacings for both transmission and reception. The first technique was successfully evaluated with a Radar Set AN/MPQ-4. A multiple beam antenna has the advantage of requiring relatively few radiators. Thus the antenna is lightweight, easy to construct, and not difficult to scan. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE SUPERREGENERATIVE PARAMETRIC AMPLIFIER, by Bernard B. Bossard, William Fishbein and Emerson Frost. 15 July 60, 24p. 1 ref. USASRDL Technical rept. 2136.
Order from LC mi$2.70, ph$4.80 PB 152 194

Recent experiments conducted at USASRDL have shown the feasibility of combining the low noise capability of the parametric amplifier with the high gain obtainable from use of superregenerative techniques. Superregenerative parametric amplifiers were built to operate at 1450 megacycles (L-Band) and 8500 megacycles (X-Band). The L-Band amplifier exhibited a gain of 70 decibels, a 3-megacycle bandwidth, and a minimum detectable signal of -104 dbm. The X-band amplifier exhibited a 52-decibel gain and a 3-megacycle bandwidth when utilizing a varactor with a cutoff frequency of 41 kilomegacycles. The superregenerative parametric amplifier has simplicity, high gain, a low noise figure, and insensitivity to certain types of interference. The size and weight are small and power consumption is low. Many elements of the technique may be utilized in low-cost communication systems. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
TEST SET, RADIOSONDE TA-1348 (XE-1)/GMM-1A, by V. T. Carbone and A. J. Montedoro. 15 July 60, 20p. USASRDL Technical rept. 2134; AD-241 178.
Order from LC mi$2.40, ph$3.30 PB 152 192

This report covers the development, design, and evaluation of Test Set, Radiosonde TS-1348(XE-1) /GMM-1A which satisfactorily detects deficiencies in Battery Pack BA-259/AM and Radiosonde AN/AMT-4 or AN/AMT-12 ( ) during preflight testing. (Author).

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE SHROUD ANTENNA, by Victor W. Richard. June 60, 22p. 6 refs. Memo. rept. no. 1283.
Order from LC mi$2.70, ph$4.80 PB 150 958

The Shroud antenna was designed for VHF telemetering and Doppler tracking instrumentation use on high velocity rockets which require a small, light-weight antenna with an omnidirectional radiation amplitude, constant phase, pattern. A unique method of installation of the Shroud antenna system is used which does not require rocket body modification, mounting holes or bolts. The antenna elements are held fast to the rocket body with metal straps, facilitating convenient, secure mounting. The Shroud antenna has withstood successfully the high acceleration and temperature environment of the Nike-Cajun rocket which has a peak acceleration of 80 g's and attains a speed of Mach 6 as low as 50,000 feet. The flat plate area of the antenna is small, presenting low drag. High temperature resistant materials are used to withstand the extreme heat generated by air friction. Properties of the Shroud antenna discussed include: the basic theory of operation, radiation amplitude and phase patterns, gain, efficiency, voltage breakdown, radiation efficiency, impedance matching, construction, installation, adjustment and flight performance. (Author)

Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.
RESEARCH INVESTIGATION OF CATHODE EMISSIVE MATERIALS, by W. E. Danforth. Scientific rept. no. 9 on Contract AF 19(604)3904. 15 July 60, 25p. 5 refs. AFCRL-TN-60-798.
Order from LC mi$2.70, ph$4.80 PB 152 040

Existing data relative to the evaporation rate of a thorium monolayer as a function of coverage and temperature, taken at Barto[1] and from other sources, is compared with a theory of Reiss suggested by Moore and Allison. Although the spread of the data is greater than desired, the theory describes satisfactorily the form of the curves when reasonable values are used for binding energy and repulsive energy between nearest neighbors. We have measured previously the thorium coverage on polycrystal tungsten corresponding to maximum emission. Studies are now being made with a tube in which thorium is deposited in equal amounts on polycrystal and single crystal tungsten. Activation of the single crystal ribbon is qualitatively very similar to that with polycrystal specimen. Quantitative differences exist but have not yet been defined. X-ray determination of the orientation of the single crystal specimen is in progress. One tube has been processed in which a ZrC specimen is heated by electron bombardment for thermionic measurements. Richardson constants in rough agreement with those by R. W. Pidd et al., are obtained. Life tests of thorium impregnated matrix cathodes have run to 12,000 hours at 2.3 amps/cm^2. A life of greater than 4500 hours have been obtained at 3 amps/cm^2. Studies are in progress relative to the role played by carbon in inhibiting evaporation of thorium. (Author). (See also PB 148 517).

Bell Telephone Labs., Inc., New York.
CRYSTAL RECTIFIERS. Interim technical rept. no. 8, 1 Apr-30 June 56, on Engineering Services on Transistors, Contract DA 36-039-sc-5589. 15 July 56, 26p.
Order from LC mi$2.70, ph$4.80 PB 152 657

This report released for sale to the public 16 Nov 60.

Improved performance in microwave transmitting modulators has been demonstrated with gold-bonded diodes. This result is attributed to minority carrier storage. Theory indicates that diodes which maximize this effect can also lead to improved harmonic generators and more reliable microwave receivers. Fabrication of such devices by solid-state diffusion is being attempted. (Author)

Bright Star Industries, Clifton, N. J.
FLAT CELL MAGNESIUM DRY CELL BATTERIES, by F. A. Keller. Semi-annual progress rept. no. 2, 1 Apr 59-1 Apr 60, on Contract DA 36-039-sc-78231. [1960] 13p. AD-240 503.
Order from LC mi$2.40, ph$3.30 PB 150 804

22 1/2 volt stacks submitted for tests failed due to serious trouble with the duplex electrode. (Author) (See also PB 145 803)

Case Inst. of Tech., Cleveland, Ohio.
STUDY OF CONTROL OF APERTURE FIELDS. Scientific rept. no. 15, 30 Nov-59-30 May 60, on Contract AF 19(604)3887. 1960, 35p. 29 refs. ERD TN-60-777.
Order from LC mi$3.00, ph$6.30 PB 150 648

Progress is reported on work in the following areas: Anisotropic Properties of Artificial Dielectrics, (a) Disc Medium, (b) Higher Order Approximations for the Polarizabilities of Thin Circular Discs, (c) Two Dimensional Strip Medium, Probe-Obstacle Interaction in a Parallel-Plane Medium, Solid Angle Reflector Synthesis, Measurement of Surface Currents, Network Synthesis. (See also PB 146 918)

Centre de Physique Electronique et Corpusculaire (France).
WIDE DYNAMIC RANGE BARRIER GRID STORAGE TUBE T. C. M. 16, by G. Wendt. Quarterly rept. no. 2 on Contract N62558-2275. 1 Dec 59, 26p. WR. 473. AD-230 552.
Order from LC mi$2.70, ph$4.80 PB 152 092

Previously the reproducibility of the 06 SMD electron guns seemed to be good, including good linearity between the beam current and the collector-aperture current. It appears now, after having assembled a larger number of TCM 16 tubes, that the percentage of guns with a linear characteristic is rather low. The possible causes for these failures are discussed. The Faraday cage which was set up had to be replaced by a larger one. The good resolution obtained on TCM 14 tubes of the J type led to a periodic irregularity on the output signal due to the grid structure. It was possible to manufacture grids of twice smaller pitch: 40 wires per millimeter, and to stretch them on the frame and insulator. Such a target assembly is being introduced in a TCM 14 tube. In the gun using deflection as a means for modulation, the two pairs of plates used for beam current modulation and beam recentering had different sensitivity. The modulation voltage had to be divided before being applied to one of them. This inconvenience was corrected. (Author) (See also PB 148 868)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
INVESTIGATION OF NOISE GENERATION IN ELECTRICALLY TUNABLE MICROWAVE OSCILLATORS. Quarterly progress rept. no. 3, 23 Dec-23 Mar 60, on Contract DA-36-039-sc-84524. [1960] 57p. 7 refs. Research rept. EE 466; AD-240 097.
Order from LC mi$3.60, ph$9.30 PB 150 817

Local oscillator noise of 6 backward-wave oscillators, type VA-161 Varian was measured over a range of 8.2 to 10.0 kmc. The order of magnitude of the measured S/N per mc bandwidth 30 mc away from the carrier was 0.1×10^{10} to 2.0×10^{10}. From the normal mode analysis of periodic transmission systems with nonuniform current excitation, an equivalent circuit suitable for use in BWO (backward-wave oscillator) analysis was derived. This equivalent circuit utilizes the special symmetry properties of helices. Certain of the important parameters of the tape helices are presented. A description of the amplitudes, phase, and frequency relationships is made for a reflex klystron oscillator in the locked region of oscillation as determined by a synchronizing signal. The general nature of the results apply to all self-excited oscillators, and these results are not limited to small synchronizing signals. The technique used may be applied to any oscillator whose nonlinear characteristic is known, either from analysis or from experiment. It is interesting to observe that a finite region of locking always exists for a finite synchronizing signal. (Author).

Cruft Lab., Harvard U., Cambridge, Mass.
RADIATION PATTERNS OF ANTENNA ARRAYS CONSISTING OF DIPOLES COUPLED TO A TWO-WIRE LINE, by Kun-Mu Chen. Scientific rept. no. 8, series 2, on Contract AF 19(604)4118. 20 May 60, 22p. 4 refs. ERD-TN-60-764.
Order from LC mi$2.70, ph$4.80 PB 150 552

The radiation pattern of a pair of tilted dipoles coupled electromagnetically to a two-wire transmission line is found. Six antenna arrays consisting of dipoles coupled to two-wire lines for different purposes are suggested and the radiation pattern for each array is obtained. (Author).

David Sarnoff Research Center, Princeton, N. J.
ELECTRON EMISSION STUDIES, by G. A. Morton, A. H. Sommer and others. Quarterly rept. no. 5, 1 Oct-31 Dec 59, on Contract DA 36-039-sc-78155. [1959] 35p. 6 refs. AD-234 230.
Order from LC mi$3.00, ph$6.30 PB 150 815

Progress is reported for work accomplished on the following: (1) photoemission induced by an internal

field in Cs-treated silicon and germanium, (2) scanning of surface to study origin of photoemission induced by an internal field, (3) theoretical considerations concerning photoemission induced by internal field, (4) surface studies of cleaved silicon crystals, (5) hot electron emission from Cs-treated germanium, (6) investigations of hot electron emission in image tubes, (7) luminescence associated with hot electron emission, (8) chemistry of the silicon-cesium system, and (9) evaporation of MgO by electron bombardment. (Author)
(See also PB 150 814)

David Sarnoff Research Center, Princeton, N. J.
HIGH TEMPERATURE SEMICONDUCTOR RESEARCH, by J. Blanc, R. Bube and others. Scientific rept. no. 2, 1 Feb-31 May 60, on Contract AF 19(604)6152.
30 June 60, 67p. 26 refs. ERD TN-60-759.
Order from LC mi$3.90, ph$10.80 PB 150 963

Contents:
GaP and GaAs-GaP alloys
Preparation of pure material
Impurity behavior
Evaluation of Material properties
Device studies
(See also PB 147 296)

David Sarnoff Research Center, Princeton, N. J.
RESEARCH IN ELECTRON EMISSION FROM SEMICONDUCTORS, by A. H. Sommer, W. E. Spicer and others. Quarterly rept. no. 6, 1 Jan-31 Mar 60, on Contract DA 36-039-sc-78155. [1960] 23p. 5 refs. AD-238 923.
Order from LC mi$2.70, ph$4.80 PB 150 816

The luminescence accompanying hot electron emission due to avalanche breakdown was measured and the voltage dependence of the emission was compared with that of the field induced photoemission to establish the voltage at which avalanche breakdown begins in Si and Ge. Experiments with different doping concentrations in the n- and p- type regions were carried out to determine the nature and place of the breakdown. Hot electron emission and rectification were studied on crystals which were outgassed at lower temperatures than previous samples before being exposed to cesium. With the help of an image tube a preliminary experiment was made to establish whether a larger emitting area can be obtained by suitable geometrical configuration. The nature of the reactions of Cs with Ge and Si was further investigated, in particular to find out whether, at the temperature used for hot electron emission activation, Cs forms a compound with Ge and Si. (Author) (See also PB 150 815)

David Sarnoff Research Center, Princeton, N. J.
THERMIONIC EMISSION STUDIES, by G. A. Morton, A. H. Sommer and others. Quarterly rept. no. 2, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-78155. [1959] 23p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 150 813

The tungsten bronzes of Na, Rb and Cs have been synthesized and their thermionic emission has been studied. First results are not promising. The secondary emission of Cs-tungsten bronze has been measured; its low value is in agreement with the low thermionic emission. Work has been started on an investigation of rare earth oxides. Progress has been made in developing an optimum surface treatment of Si with Cs. The pulse equipment for measuring HEE has been completed and successfully used. Efficiencies larger than those previously reported in the literature and pulsed currents greater than 1 ma have been obtained from junctions. Indications have been found that photocathodes of the Ag-O-Cs type are "hot electron" emitters under suitable conditions. An ultra-high vacuum system is nearing completion in which surfaces of vacuum -cleaved Si crystals are to be investigated. A modified image orthicon tube has been designed to study contact potential differences on Si p-n junctions. (Author) (See also PB 145 236)

David Sarnoff Research Center, Princeton, N. J.
THERMIONIC EMISSION STUDIES, by G. A. Morton, A. H. Sommer and others. Quarterly rept. no. 4, 1 July-30 Sep 59, on Contract DA 36-039-sc-78155. [1959] 30p. 3 refs. AD-231 405.
Order from LC mi$2.70, ph$4.80 PB 150 814

The thermionic emission from the rare earth oxides Y_2O_3, La_2O_3 and Sm_2O_3 was measured and the corresponding ϕ and A values have been derived. Work on these materials will be discontinued, at least for the time being. Contact potential differences between vacuum-cleaved silicon crystals and a tungsten ribbon was measured. Work function values were obtained for three crystals containing different amounts of impurities. By cleaving each type of crystal at least twice, it could be shown that the method leads to reproducible values for each sample. A grown n-p-n Si junction was used as a target in a low velocity beam scanning tube. For the first time, the p-n junctions were observed on the display tube without using a biasing potential across the crystal. Current-voltage characteristics were measured in a new Cs activated tube. Measurements on this and earlier tubes were correlated and a provisional interpretation of the results obtained to date is suggested. (Author) (See also PB 147 272)

Diamond Ordnance Fuze Labs., Washington, D. C.
ADAPTIVE SERVO TRACKING, by A. I. Talkin.
20 Sep 60, 22p. 6 refs. TR-860.
Order from LC mi$2.70, ph$4.80 PB 152 311

This report describes a self-adapted sampled-data tracking loop. The tracking loop may be considered to be a low-pass filter with a variable bandwidth. The loop is designed to adapt rapidly to changes in the input signal by monitoring both the apparent error and the loop output. Results show a tracking accuracy of 25 to 34 percent higher than that of a comparable linear system at a receiver S/N ratio of 10 db. In other terms, to attain the same accuracy the comparable linear system requires an S/N ratio of 13 db. This improvement in performance is obtained with relatively little additional circuitry. In general, the degree of improvement obtained by adaptive tracking will depend on the compromises made in the design of the unadapted loop to track the most difficult type of target. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
DOFL HIGH-G TELEMETRY SYSTEM, by Gilbert M. Rosenberg, John C. Tomasello, and Walter L. Gieseler. Interim rept. no. 1, 27 May 60, 28p. 9 refs. TR-841.
Order from LC mi$2.70, ph$4.80 PB 150 318

Preliminary design and evaluation data are presented on a 200,000-g telemetering system, capable of measuring temperature and other parameters from missiles during high-speed flight. Design considerations, components shock-test results at high g, illustrative results of missile-firing tests, and an outline for future design investigations are included. This system incorporates an rf oscillator operating at a frequency of approximately 65 Mc and frequency modulated by a fixed-frequency subcarrier oscillator. Missile firing of the present system has been made from powder guns. With the final design, the high speeds and setback will be produced by firing from light gas guns. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
LIGHTWEIGHT HIGH-DRAIN ZINC-SILVER OXIDE BATTERY, by Gilbert R. Snyder. 22 Aug 60, 25p. 5 refs. TR-859.
Order from LC mi$2.70, ph$4.80 PB 152 314

The PS-503 reserve-type power supply has been designed for use in a compact electronic device. The electrically initiated, zinc-silver oxide power supply will function over the temperature range of -40 to +160°F with a current density of approximately 0.5 amp/in.^{2} of projected electrode area. This miniaturized power supply was made possible by earlier work described in DOFL Report TR-560. The battery consists of two voltage sections: a 1.4-v section and a 6.7-v section. It is activated by a pressure-vacuum system without auxiliary heat or heating devices. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
MAGNETRON GUNS. AN EXACT THEORETICAL TREATMENT, by William E. Waters. 27 Apr 60, 77p 10 refs. TR-843.
Order from LC mi$4.50, ph$12.30 PB 152 309

The properties of an electron optical system in which a space-charge-limited current is emitted from a conical cathode, immersed in a uniform axial magnetic field, are discussed. All necessary equations pertinent to a static space-charge flow are combined into a system of four ordinary, nonsingular differential equations; these have been solved simultaneously on a high-speed digital computer, and pertinent computer calculations are presented in graphical form. An exact solution is given for the properties of an annular rotating electron beam, in which each electron moves in a helical path of constant pitch, the magnetic field is uniform and axial, and all electrons possess the same angular velocity about the axis. A numerical example is presented for a particular gun design, together with a few brief statements concerning the actual performance of the experimental gun that was built from this design. The characteristics of the theoretical flow patterns are interpreted, and mathematical relations are presented. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
A STUDY OF ELECTRICAL PROPULSION OF ORDNANCE LAND VEHICLES, by H. D. Cather. 30 Sep 60, 33p. 22 refs. Technical rept. TR-777.
Order from OTS $1.00 PB 171 026

A study of future Ordnance vehicle characteristics, their power requirements, and of known sources of electrical energy leads to the conclusion that an electrical propulsion system can provide marked, new capabilities in mobility and that the fuel cell system offers the best possibility of providing the required power plant. A fuel cell/electric motor system can provide many of the desired characteristics of a propulsion system, such as (1) utilization of a variety of fuels at a new level of efficiency (2) freedom in vehicle design (3) low field maintenance, and (4) lessened field detectability. Major technical advances are required both in terms of fuel cells and motors before a practical objective can be met. (Author)

Dielectrics Lab., Johns Hopkins U., Baltimore, Md.
DIELECTRICS FOR OUTER SPACE, by Louis J. Frisco. Interim rept. no. 1, 1 Mar 59-30 Apr 60, on Contract DA 36-039-sc-78321. 31 May 60, 66p. 16 refs. AD-240 028.
Order from LC mi$3.90, ph$10.80 PB 150 806

The results of the first phase of a study of the effects of simulated high altitude environment on the electrical properties of electrical insulating materials are reported. Tests have been made for periods up to 96-hours in high vacuum, in the presence of ultraviolet and 50-kv x-ray radiation. Measurements of flashover strength from 60-cps to 18-mc, dielectric constant and dissipation factor from 60-cps to 100-mc, and d-c surface and volume resistivity have been made on Alathon 4 BK 30, Alox (aluminum oxide), glass polyester laminate, and Formica FF-95 printed wiring board. Observed changes in electrical properties are associated mainly with thermal effects, except in the case of flashover. Electrode effects prove to be important in high vacuum flashover phenomena, causing minimum values in high vacuum to be comparable to the low values obtained at atmospheric pressure. (Author)

Digital Computer Lab., Mass. Inst. of Tech., Cambridge.
RELAY AND CONTACT LIFE TEST, by Robert E. Hunt. 3 Mar 52, 8p. Engineering note E-452; AD-71 333.
Order from LC mi$1.80, ph$1.80. PB 150 754

This report released for sale to the public 25 Oct 60.

A relay life test rack was set up and operated for 18 million cycles. Clare type J and Allied type BO relays were used. Relay performance was excellent, but the results of the test show that the most important single factor in applying relays is arc-suppression. The second and most important factor is cleanliness.

Electric Storage Battery Co., West Orange, N. J.
HIGH CAPACITY VENTED NICKEL-CADMIUM CELLS, by Arthur Fleischer, Edward C. Kopper and others. Quarterly rept. no. 2, 1 Mar-31 May 60, on Contract DA 36-039-sc-84555. [1960] 83p. 7 refs.
Order from LC mi$4.80, ph$13.80 PB 152 187

Six additional 23-plate Type SC4 cells were assembled after sintering and impregnating master plaques. The capacity testing program on the 39 Type SC4 cells assembled with 23-, 19-, 15- and 11-plate elements having positive plates impregnated in nickel nitrate solution containing 0, 5, and 10% cobalt and Edison process positive plates was completed with the determination of capacities at the 5-hour discharge rate at room temperature and -40° and at the 15-minute rate at room temperature. The results of the capacity test were analyzed and a numerical analysis applied to evaluate the effects of the variables. It was found that there was an alternation in the relative capacities considered in relation to the number of plates. All cells having 15-plate and 11-plate elements failed to meet the capacity requirement for the Type SC4 cell at the 5-hour rate at -40°. All cells met the capacity requirement for the Type SC4 cell on discharge at the 15-minute (3C) rate at room temperature. There was an indication that the Polypor separator tended to shed the microporous coating. The analysis of the test results led to the selection of the plate thicknesses of the 19-plate Type SC4 cell as the optimum combination for the production cells of the six types. The Edison process positive plates were tested in the 15-plate SC4 cells which did not meet the low temperature requirement. (See also PB 149 118).

Electrical Engineering Research Lab., U. of Illinois, Urbana.
BEARING AVERAGING USING TWO OR MORE SPINNING GONIOMETER RDF SYSTEMS, by Fred John Wymer. Thesis. Technical rept. no. 15 on Contracts Nonr-1834(02) and DA 36-039-sc-74898. 24 Dec 59, 98p. 13 refs. AD-231 860.
Order from LC mi$5.40, ph$15.30 PB 152 131

By using two or more Adcock Antenna arrays, and averaging the indications from each one, an "instantaneous" average bearing can be obtained. The equipment used in this investigation was designed to perform the algebraic manipulations determining the bearing indication, and was used to show the validity of the analysis. It was tested in the laboratory using two channels to represent two RDF systems. The problem, then, was to develop equipment which would average the bearing indications from two Adcock antenna arrays. The purpose was to show that this system could be used to reduce the errors in bearing indications due to interfering components at the carrier frequency. The development of an optimum distribution of arrays was also desired, and for this purpose, the effects of various parameters on the averaged bearing indication was desirable. (Author).

Electronic Tech. Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
ABRASION RESISTANCE OF HIGH-TEMPERATURE COAXIAL CABLE JACKET MATERIALS, by Bard Suverkrop. Rept. on Thermionic and Solid State Electronic Technology. Apr 60, 8p. WADD Technical note 60-75.
Order from OTS $0.50 PB 171 118

Three different jacket materials for flexible, coaxial cables that will be used at temperatures of 200°C are evaluated for their abrasion resistance. These materials are (1) silicone-varnish-impregnated Fiberglas braids, (2) extruded fluorinated ethylene propylene resin, and (3) silicone-rubber polyester fiber braids. Results indicate that jackets (2) and (3) have approximately 14 times the abrasion resistance of jacket (1). (Author)

Electronic Tech. Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE WADC SYMPOSIUM ON METAL FILM RESISTOR PROCESSES, TECHNIQUES, AND CAPABILITIES, by Robert E. Conklin. Rept. on Improved Electronic Components. Feb 60, 203p. 11 refs. WADC Technical rept. 58-468; AD-235 996.
Order from LC mi$9.30, ph$31.80 PB 152 360

This report released for sale to the public 28 Oct 60.

The objectives of this symposium were threefold: (1) to provide an organized survey of the research and development effort of film resistors of the metallic film type, and to provide a basis for the assessment of effectiveness and progress of the total research and development effort as well as the present state-of-the-art; (2) to serve as an incentive to investigators in the metal film resistor field and to reduce the results of their efforts to writing for the benefit of all; (3) to further the work being done by Industry of metal film resistors by providing them with the latest information available to the government on the subject and thereby expedite the commercial availability of more reliable items for military use. The symposium papers cover a wide latitude of subjects and deal with the following general areas of interest: (1) physics of thin metallic films, (2) laboratory techniques for manufacturing thin film resistors, (3) techniques for evaluating the capability of metal films, (4) the problems encountered in developing production capability, (5) problems encountered in the research and development of metal film resistors, and (6) capabilities of metal film resistors. (Author)

Electronics Research Lab., Northeastern U., Evanston, Ill.
STUDIES OF COMMUNICATION CHANNELS, by Sze-Uou Chang, Robert D. Klein and others. Scientific rept. no. 3, Pt. II, on Contract AF 19(604)3053. 17 May 60, 43p. 9 refs. AFCRC-TN-60-574(II).
Order from LC mi$3.30, ph$7.80 PB 150 645

This report is a brief summary of the progress to date in miscellaneous studies of communication channels. The following topics are discussed: (1) The capacity of a symmetrical binary channel with uniform digit spacing, exponentially decaying memory, and additive Gaussian noise is approximated by a numerical method. (2) Discrete channels are combined to form cascaded, sum, product, or other networks in order to achieve such objectives as increasing range, capacity, or reliability. (3) Feedback systems for the reduction of multipath distortion have been evaluated. (4) A study has been carried out of mathematical techniques applicable to the combination of fallible formal neurons as proposed by McCulloch. (Author)

Electronics Research Lab., U. of California, Berkeley.
FERROMAGNETIC CORE FUNCTIONS IN THE ANALYSIS AND DESIGN OF SELF-SATURATING MAGNETIC AMPLIFIERS, by H. C. Bourne and D. Nitzan. Rept. on [Contract Nonr-222(74)] 1 Dec 59, 122p. 13 refs. Series no. 60, issue no. 261; AD-233 509.
Order from LC mi$6.30, ph$19.80 PB 146 750

The object in this study is to analyze the three types of self-saturating magnetic amplifier circuit in a general form, appliable for design purposes. Based on ferromagnetic domain walls theory, a general core function in terms of mmf F, flux ϕ and ϕ is derived.

Electronics Research Lab., U. of California, Berkeley.
REGENERATIVE MODES OF ACTIVE NETWORKS, by E. S. Kuh. Rept. on Contract N7onr-295(29). 3 Nov 59, 8p. 5 refs. Rept. no. 97; IER series no. 60, issue no. 258; AD-230 482.
Order from LC mi$1.80, ph$1.80 PB 150 511

An active device with passive imbedding can produce natural frequencies in the right half plane. In the design of regenerative circuits, it is important to find the permissible location of regenerative modes. The maximum real part of the natural frequency of an active device under arbitrary passive imbedding was determined. It is shown that this regenerative mode can actually be realized. For the case of a pentode, the required passive network is a gyrator. (Author).

Electronics Research Lab., U. of California, Berkeley.
VARIABLE-CAPACITANCE PARAMETRIC AMPLIFIERS, by N. Kumagai. Rept. on Contract N7onr-29529. 17 Dec 59, 17p. 7 refs. Rept. no. 98; Series no. 60, issue no. 263; AD-233 477.
Order from LC mi$2.40, ph$3.30 PB 152 115

Variable-capacitance parametric amplifiers have been constructed and operated satisfactorily at S-band. Two resonant modes in the rectangular cavity have been used as the signal and idling tank circuits. The pump power has been fed directly into the variable-capacitance diode through a coaxial feeder making use of no resonant circuit at the pump frequency. The dual-mode cavity circuit has the following advantages: (1) the dimensions and weight of the amplifier can be reduced since only one cavity supporting two resonant modes is used. (2) Since no resonant circuit for the pump power is required, the practical difficulties of the frequency adjustment are reduced. (3) The pump power is reduced to some extent because the diode is driven directly through the pump feeder. (Author).

Essex Electronics, Berkeley Heights, N. J.
CHARACTERIZATION OF I-F TRANSFORMERS, by Charles V. Longo. Final rept. for 1 Nov 54-30 June 57 on Contract DA 36-039-sc-64522. [1957] 235p. 15 refs. AD-202 838.
Order from LC mi$10.20, ph$36.30 PB 150 679

Specification and characterization procedures in common usage in the industry as of the beginning of project activity are described. The shortcomings of these procedures are pinpointed and the requirements of a satisfactory characterization procedure are delineated. The important literature items which were consulted during the background study are cited and two proposals for solution evolved from this study are described in broad outline. The two proposed methods are considered in turn. The detailed application is described and test results presented. It is shown that Method I, which relies upon parameter measurement, cannot satisfy the essential accuracy requirements in the present state of the measurement art. The successful application of Method II, which relies upon direct measurement of gain-bandwidth performance, is related chronologically in conjunction with the presentation of numerical test data. The development of ideas, techniques and equipment pertaining to each phase of the operational procedure is described under appropriate subheadings. A summary evaluation of the method includes a listing of the variables requiring control and the degree of control required for successful results. (Author).

General Electric Co., Owensboro, Ky.
ELECTRON TUBE EMISSION STABILITY, by John D. Jordan. Rept. on Thermionic and Solid State Electronic Technology, Contract AF 33(600)32562. Feb 60, 103p. WADD Technical rept. 60-286.
Order from OTS $2.50 PB 171 117

Previous work has indicated that tubes are unstable to some degree during the first few hours of life. An investigation was made as to the magnitude and time duration of this instability and what factors affect the stability. (Author)

General Electric Co., Schenectady, N. Y.
ELECTRIC DISCHARGE IN RF CABLES, by W. T. Starr, E. G. Bianco, and J. Godfrey. Quarterly rept. no. 1 on Contract DA 36-039-sc-78147. 16 Oct 58, 80p. 3 refs. AD-207 809.
Order from LC mi$4.50, ph$12.30 PB 152 667

This report released for sale to the public 16 Nov 60.

The interrelationships between life and electrical discharge characteristics will be determined over a range of temperatures, voltages, and frequencies. Preliminary planning of the life test experiment, including the choice of variables together with the "surface fitting" technique of Dr. G. E. P. Box is described. The development of a cost-saving cable termination which makes use of available aluminum funnels and RTV silicone rubber is included. A statistical commentary on life testing is supplied which includes mathematical concepts useful for interpretation of results and for shortening the time requirements of the life test. A computer program was developed for estimating Weibull parameters on the life test data with maximum accuracy. A survey of the literature is included on the mechanism of electric discharge, internal and surface discharges, effects of discharges on polyethylene and butyl rubber, cable discharges, and discharge measurement. (Author)

General Electric Co., Syracuse, N. Y.
70-AMPERE HIGH POWER SILICON CONTROLLED RECTIFIER, by R. M. Hunter, G. N. Hall and R. P. Lyon. Final rept. for 19 Jan 59-18 Jan 60 on Contract DA 36-039-sc-78278. [1960] 134p. 7 refs.
Order from LC mi$6.90, ph$21.30 PB 150 805

The results of studies and investigations to optimize device properties vs. emitter and base resistivities, diffusion parameters, junction areas, layer thicknesses, gate and cathode geometries as well as studies in the theory of operation of the three terminal PNPN structure are presented. Fabrication techniques, equipment descriptions and parts drawings to duplicate the devices delivered are furnished and data on sample devices is included. Conclusions and recommendations are also presented. (Author) (See also PB 145 815)

ITT Labs., Nutley, N. J.
RESEARCH INVESTIGATION OF RECTIFIERS FOR MAGNETIC AMPLIFIERS IN MISSILES, by G. R. Leef. Final rept. for June 54-May 58 on Contract DA 36-039-sc-64492. Oct 58, 179p. 3 refs. AD-211 953.
Order from LC mi$8.10, ph$27.30 PB 150 678

The development of two diffused-junction silicon rectifier models, basically rated at 50 ma and 2 amperes and intended for use in printed circuit applications, is described. Test data show that these rectifiers are capable of meeting most of the target specifications. Experimental data showing the performance of rectifiers in a magnetic amplifier circuit and also measurements of reverse recovery current effects in rectifiers are presented. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE ACM-52 AUTOMATIC CLUTTER MAPPER AND PRELIMINARY EXPERIMENTAL RESULTS, by J. N. Harris and E. J. Madle. Rept. on Contract AF 19(604)5200. 30 July 59, 52p. 19 refs. Technical rept. no. 206; AD-230 025.
Order from LC mi$3.60, ph$9.30 PB 150 594

The ACM-52 Automatic Clutter Mapper is a special-purpose, digital-data processing system. The ACM-52 accepts, stores and processes up to eight complete scans (frames) of slowed-down video (SDV) data. A fixed, but readily adjustable, program causes the stored information to be processed so as to yield a mapping function. This function can then be used to blank out portions of a display where returns occur too frequently - a characteristic of certain types of clutter. Preliminary experimental results indicate the usefulness and flexibility of ACM-52 as a research tool in investigating the nature of SDV clutter. Its current use at a test site may indicate the possibility of using this technique to replace a similar task now performed by a human operator. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADDITIONAL TESTS ON THE AN/FRC-47 (XD-1) MOCK-UP SYSTEM, by B. E. Nichols. Rept. for Apr-Oct 59 on Contract AF 19(604)5200. 11 Mar 60, 10p. Group rept. 36-44.
Order from LC mi$1.80, ph$1.80 PB 152 041

Several series of tests and measurements were made over the Millstone Hill – Sauratown Mountain system using the AN/FRC-47(XD-1) mock-up equipment to measure both system performance and propagation effects. The equipment operates in the 400-Mcps region over the 640-mile path. As a communication system, single-sideband modulation is employed with 4th-order diversity, but the equipment may also be used in other manners for specific tests.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
ANALYSIS OF SOME DETECTION CRITERIA FOR PULSE RADAR, by E. J. Kelly, D. H. Lyons and others. Rept. on Contract AF 19(122)458. 24 Jan 58, 18p. 4 refs. Technical rept. no. 172; AD-110 039.
Order from OTS $2.40, ph$3.30 PB 150 608

The detector input is assumed to consist of a sequence of samples of the IF modulation taken at regular intervals of time $t_o + (n-1)T$, $n = 1, 2, \ldots, N$ and T is the time interval between transmitter pulses. The sequence of samples of the IF modulation taken is $z(t_o)$, $z(t_o + T), \ldots, z[t_o + (n-1T]$, where $z(t)$ is the complex video process $z(t) + iy(t)$. The discrete signal process, without noise, is assumed to be of the form $S_n = S[t_o + (n-1)T] = A \exp [i(n\psi + \delta)]$, where the Doppler phase is $\psi = D\,T$ and $\delta = \omega D(t_o + T) + \delta_o$. This process applies exactly to a fixed-antenna radar and approximately to a scanning radar if the number of pulses is sufficiently small. The method of maximum likelihood is used, and formulas relating to sensitivities and false-alarm rates are obtained.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE CHARACTERIZATION OF CHANNELS WITH RAPID MULTIPLICATIVE PERTURBATIONS, by Herbert Sherman. Rept. on Contract AF 19(604)5200. 26 Aug 60, 48p. 20 refs. 25 G-0004.
Order from LC mi$3.30, ph$7.80 PB 150 796

Lincoln Lab., Mass. Inst. of Tech., Lexington.
DESIGNING FOR RELIABILITY, by N. H. Taylor. Rept. for 1948-1956 on Contract AF 19(122)458. 9 Dec 56, 59p. Technical rept. no. 102; AD-93 756.
Order from LC mi$3.60, ph$9.30 PB 152 295

This report released for sale to the public 25 Oct 60. The achievement of reliability is a goal that must be pursued from the very beginning of the system design project. The first step is to consider each individual component to be used in the system and to critically analyze its capabilities and limitations. The second step in the design project is to determine the applications of these components that tend to take advantage of the best capabilities of these components and avoid their worst limitations. This report lists analyses of components and the resulting component applications that have been made over a period of several years. The third and final phase of the design project is the actual electronic circuit design, based on the component analyses and applications notes derived earlier and predicated on the achievement of high reliability. The thorough design method is described in detail. This method provides reasonable component tolerances and adequate safety margins, and incorporates marginal checking throughout the design process. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
A METHOD OF PULSE COMPRESSION EMPLOYING NONLINEAR FREQUENCY MODULATION, by E. L. Key, E. N. Fowle, and R. D. Haggarty. Rept. on Contract AF 19(604)5200. 13 Aug 59, declassified Mar 60. 11p. 3 refs. Technical rept. no. 207.
Order from LC mi$2.40, ph$3.30 PB 150 595

In many of the pulse compression systems that have been recently built or proposed, the receiver has been deliberately mismatched to achieve a more desirable receiver output waveform. In particular, most linear FM pulse compression systems employ, in the receiver, some sort of weighting network designed to suppress the side lobes of the signal autocorrelation function. The deviation of the receiver from a matched filter results in a loss in detection capability. We present here a pulse compression method that achieves a desirable receiver output waveform and, at the same time, requires the receiver be an exact matched filter to the signal transmitted; in addition, the transmitted waveform is made to have an approximately rectangular envelope. The method permits the receiver output or autocorrelation function and the time duration and envelope shape of the signal to be transmitted to be independently specified at the outset. The method hinges upon one's ability to specify the phase characteristic of a dispersive all-pass network. An approximate expression for the phase characteristic is derived in terms of the envelope shape desired and the signal energy density spectrum. The quality of the approximate relation improves as the signal bandwidth-time product increases. The method is illustrated by an example. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
A METHOD OF SIDE-LOBE SUPPRESSION IN PHASE-CODED PULSE COMPRESSION SYSTEMS, by E. L. Key, E. N. Fowle, and R. D. Haggarty. Rept. on Contract AF 19(604)5200. 28 Aug 59, 8p. Technical rept. no. 209; AD-229 403.
Order from LC mi$1.80, ph$1.80 PB 150 597

This report presents a method whereby the side-lobe level of a phase-coded pulse autocorrelation function may be suppressed, in principle, to any desired level. The side lobes are suppressed by mismatching the receiver; consequently, the detection capability is reduced. The method is explained by an example wherein a weighting network is designed to suppress the side lobes of a particular phase-coded pulse autocorrelation function. A bound is placed upon the loss in detection that is caused by this weighting. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
PARABOLOIDAL REFLECTOR PATTERNS, by R. L. Pease. Rept. on Contract AF 19(122)458. 5 Aug 58, 14p. 7 refs. Technical rept. no. 1841, AD-133 862.
Order from LC mi$2.40, ph$3.30 PB 150 592

Principal E- and H-plane radiation patterns are obtained analytically for a finite paraboloidal reflector with an axially symmetric feed at the focus. The effect of a quadratic phase term resulting from the use of the current-distribution method is included, without recourse to the usual plane-aperture approximation. Results are expressed in a series of Lommel functions, with coefficients proportional to the coefficients of expansion of the primary pattern in a series of orthogonal polynomials. For uniform illumination, the amplitude of the first minimum in either principal plane is approximately 1/5ka times that of the main lobe, where $k = 2\pi/\lambda$ and a is the focal length. For arbitary illumination, certain general relationships between prfmary and secondary patterns are deduced for very small and very large angles. (Author).

Lincoln Lab., Mass. Inst. of Tech., Cambridge.
PARABOLOIDAL REFLECTOR PATTERNS FOR OFF-AXIS FEED, by S. S. Sandler. Rept. on Contract AF 19(604)5200. 14 July 59, 25p. 12 refs. Technical rept. no. 205; AD-226 245.
Order from LC mi$2.70, ph$4.80 PB 148 368

The problem of predicting the radiation pattern for an asymmetrically illuminated paraboloid is covered in some detail. The current distribution method is given in a final form suitable for machine computation. An approximate analytical solution using scalar diffraction methods is compared with the experimental results and the machine solution. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
A PROBABILITY MODEL FOR COHERENT PHASE-ONLY MTI SYSTEMS, by J. W. McGinn, Jr. Rept. on Contract AF 19(604)5200. 4 June 59, 17p. 4 refs. Technical rept. no. 204; AD-220 812.
Order from LC mi$2.40, ph$3.30 PB 150 593

An approximate probability model is described for the output of a phase-only, single video-delay line coherent MTI system when the input to the system is the radar return from a moving target in sea clutter. Specific allowance has been made in the model for the inclusion of radar receiver noise effects. The model may be scaled in most of its major parameters and thus can serve as a comparative measure of performance between specific MTI systems. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
RELIABILITY MODIFICATIONS TO THE ADDER AND KINEPLEX CONVERTER, by P. L. Grant, E. J. Hofmann and others. Rept. on Contract AF 19(604)5200. 25 Aug 60, 13p. 1 ref. Rept. 25G-0017.
Order from LC mi$2.40, ph$3.30 PB 150 438

As part of the Group 25 effort in the testing of digital data systems designed to function over voice-bandwidth telephone circuits, the Kineplex converter had been built and used in conjunction with the ADDER for the testing of the Collins TE 206 Kineplex. After several weeks of testing it became obvious that pulses of external origin were causing spurious errors to be added. This report describes the methods which were used to combat this unwanted noise and the modifications in the ADDER and Kineplex converter which resulted. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
SEMICONDUCTOR DELAY LINES, by J. J. G. McCue. Rept. on Contract AF 19(122)458. 15 Apr 58, 8p. 13 refs. Technical rept. no. 179; AD-110 050.
Order from LC mi$1.80, ph$1.80 PB 150 609

The drift of minority carriers in an electric field in a semiconductor provides a mechanism for delaying a video signal. Equations are developed for the delays and rise times that may be expected. At room temperature, one can expect delays of tens of microseconds with rise times of the order of one microsecond. At lower temperatures, the delays and rise times are both shorter. It is shown that the ratio of delay to rise time depends only on the temperature and on the potential difference through which the carriers drift. Apart from these factors, the delay-to-rise-time ratio does not depend on the choice of semiconducting material. (Author).

Lincoln Lab., Mass. Inst. of Tech., Cambridge.
STUDIES IN PARTIAL SWITCHING OF FERRITE CORES, by R. H. Tancrell and R. E. McMahon. Rept. on Contract AF 19(604)5200. 21 Sep 59, 19p. 9 refs. Technical rept. no. 210; AD-227 928.
Order from LC mi$2.40, ph$3.30 PB 149 773

Under the influence of a narrow pulse of high-amplitude current (an impulse of current), only a portion of a ferrite core is switched and the core remains in a partially switched state at the end of the pulse. Partially switched states can also be achieved with low-amplitude currents that do not produce fields strong enough to switch every portion of the core. The characteristics of Mg Mn ferrite cores in various partially switched states are studied. The switching characteristics of cores under driving conditions of high- and low-amplitude currents of different widths are presented. A detailed discussion is given of the impulse switching mode of core operation to achieve increased memory speed. Additional results are presented for special cores fabricated with different geometries. It is found that the amplitude and width of the partial-switching current has a pronounced effect on the core's behavior to subsequent drive pulses. Only an inner ring of a core is switched by a low-amplitude current. With a high narrow current, flux is switched in a varying degree from the inside to the outside diameters. Models are proposed to describe the speed of switching in various regions of a core so that the percentage of flux switched in the different regions can be predicted. The model is based on the nonuniformity of the driving field across the dimensions of the core. While the information gained from this investigation, other computer applications of partially switched cores are proposed. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
TRANSISTOR LIFE IN THE TX-O COMPUTER AFTER 10,000 HOURS OF OPERATION, by D. J. Eckl and R. L. Burke. Rept. on Contract AF 19(604)5200. 14 Apr 60, 47p. Technical rept. no. 221; AD-239 227.
Order from LC mi$3.30, ph$7.80 PB 150 601

The TX-O computer began operating in April 1956. This computer is a 5-Mcps machine employing 2600 type L-5122 surface-barrier transistors in its high-speed central section. During its initial period of operation at Lincoln Laboratory, the computer had a 256 × 256 word magnetic-core memory driven by vacuum tubes. After some 6000 hours of operation, 678 surface-barrier transistors, 58 microalloy transistors, and 102 grown-junction transistors were removed for retest. The results of this examination were presented in Technical Report No. 199 and are repeated in this report. During the Summer of 1958, TX-O was moved from Lincoln Laboratory to M. I. T., and a 64 × 64 word transistor-driven core memory was substituted for the larger one. After one year of operation at M. I. T., the transistors had reached a total of about 10,000 operating hours. In July 1959, the 58 microalloy transistors and 800 surface-barrier transistors were again removed for retest, the results of which are presented in this report. During the entire period of operation, only one transistor—a light-pen-amplifier—was removed as an "uncaused" failure. No data are available on "personnel-induced" failures. Approximately 10 per cent of the transistors tested fell below original acceptance specifications, but they were returned to service and have operated normally. Certain of the parameter variations were unexpected and appear to be characteristic of surface changes in the surface-barrier transistor. The results of the transistor tests so far are excellent and surpass those originally anticipated. (Author).

Lockheed Aircraft Corp., Sunnyvale, Calif.
CATHODE RAY STORAGE TUBES, by A. A. Beltran. Special bibliography for 1947-1959. 20 Apr 60, 34p. 128 refs. SB-60-1.
Order from OTS $1.00 PB 171 127

This survey covers the work on storage tubes from late 1947 through 1959 and represents the report, periodical, and technical society literature on this subject. The sources consulted include the card catalog of the Armed Forces Technical Information Agency, the various catalogs of LMSD's Technical Information Center, Science Abstracts - Sections A & B, U. S. Government Research Reports, Engineering Index, Doctoral Dissertations, and the Abstracts and References of the Electronic and Radio Engineer (London). Russian, French, and German articles have been included only when similar material was not available in English. Storage tube fabrication processes and problems are not included.

Lockheed Aircraft Corp., Sunnyvale, Calif.
A NONLINEAR CAPACITOR HARMONIC GENERATOR SUITABLE FOR SPACE-VEHICLE APPLICATIONS, by P. M. Fitzgerald, T. H. Lee and others. Technical rept. on Physical Electronics. July 60, 41p. 8 refs. LMSD-703043.
Order from LC mi$3.30, ph$7.80 PB 152 026

This paper describes a small, compact, efficient, 9th-harmonic generator which consists of two cascaded triplers. This device was designed to operate in the environment normally encountered during the launch of a satellite and its subsequent sustained orbital flight. The results of environmental tests of shock, vibration, acceleration, and temperature are presented. In addition, the results of an analysis made on two basic harmonic generator's circuits are presented. Curves of conversion efficiency as a function of the harmonic generator's circuit parameters are presented for each circuit (for harmonic numbers 2 through 10, inclusive). This work is an extension of Chang's work and allows one to take into account the effect of lossy nonlinear elements on conversion efficiency. (Author)

Mallory, P. R., and Co., Indianapolis, Ind.
PACKAGING AND INTEGRATION OF TRANSISTOR ASSEMBLIES, by R. Albon, D. N. Lightbourne and R. L. Meek. Final rept. for 1 July 56-31 Jan 58 on Contract DA 36-039-sc-72834. [1958] 176p. 82 refs; AD-208 937.
Order from LC mi$8.10, ph$27.30 PB 150 810

This is the final report of a research and development program for the establishment of practical and effective methods of packaging and integrating transistorized printed circuit assemblies. Package analyses pertaining to integration, size and weight, thermal adequacy, climatic protection, ruggedization, and maintenance have been included. The five representative systems of integration and packaging which were developed and the work which led to their development are discussed. Specific principles and techniques compatible with transistorized printed circuit board are presented in the "Design Guide"(PB 150 809). (Author).

Mallory, P. R., and Co., Inc., Indianapolis, Ind.
PACKAGING AND INTEGRATION OF TRANSISTOR ASSEMBLIES. DESIGN GUIDE, by R. Albon, D. N. Lightbourne and R. L. Meek. Rept for 1 July 56-31 Jan 58 on Contract DA 36-039-sc-72834. [1958] 105p. 77 refs; AD-208 936.
Order from LC mi$5.70, ph$16.80 PB 150 809

This design guide provides the design engineer with information to guide him in circuit packaging and integration of printed-wire subassemblies of minimum size and weight for transistor applications. Other factors such as thermal adequacy, maintenance, ruggedization, and climatic protection are considered and designs suggested compatible with such requirements. (Author).

Melabs, Palo Alto, Calif.
INVESTIGATION OF MICROWAVE NON-LINEAR EFFECTS UTILIZING FERROMAGNETIC MATERIALS by Roy W. Roberts. Quarterly progress rept. no. 12, 1 Feb-30 Apr 60, on Contract DA 36-039-sc-73278. 1960, 35p. 4 refs. AD-239 869.
Order from LC mi$3.00, ph$6.30 PB 150 683

Two expressions for second harmonic conversion efficiency are developed in terms of a normalized sample volume, the ferrite material properties, and the impedances of the test section. The conversion efficiency can also be expressed in terms of external and unloaded Q's. It is not certain at this time whether the ferrite loss parameter which should be used in the conversion expressions should be a surface limited linewidth or a surface independent spin-lattice relaxation time. Three versions of a K-band ferrite parametric amplifier have been built and considerable tests have been carried out. Two approaches have been carried out using TE_{01} and TM_{01} signal modes. So far, no pump interaction or oscillation have been found. The third version, which has only received preliminary tests, makes use of longitudinal pumping and a large single crystal garnet sphere. (Author) (See also PB 147 994)

Melabs, Inc., Palo Alto, Calif.
RESEARCH AND DEVELOPMENT OF A SOLID STATE PARAMAGNETIC MASER, by Roy W. Roberts and Harold D. Tenney. Final rept. for 10 June 59-9 June 60 on Contract AF 19(604)4071. 30 June 60, 130p. 24 refs. AFCRL-TR-60-173.
Order from LC mi$6.30, ph$19.80 PB 150 736

Methods of broadbanding the CW solid state maser have been investigated, the most promising approach being through the use of slow-wave structures utilized in a traveling-wave maser (TWM). Several types of slow-wave structures were investigated experimentally. Best results were obtained from an "ungrounded comb" configuration. Methods of achieving non-reciprocal attenuation were investigated resulting in development of a short-circuit stable amplifier. During the TWM experimental phase cross relaxation effects were noticed. Theoretical analyses were carried out on several types of cross relaxation mechanisms and their effect on maser performance analyzed. It was shown that these effects can either enhance or degrade maser performance, depending on the type of mechanism involved, the paramagnetic ion concentration, the lattice temperature and other related parameters. A survey of methods and problems associated with high frequency masers was carried out. It appears that rutile is the most promising material for millimeter masers as the present time. (Author) (See also PB 146 323)

Michigan U. Research Inst., Ann Arbor.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF RADIOACTIVE IONIZATION GAUGES, by Mohammad A. El-Moslimany. Doctoral thesis. Scientific rept. no. HS-1 on Contracts AF 19(604)545, 1511, 1948 and 6162. May 60, 199p. 52 refs. 2096; 2406; 2597; 03554-1-S; AFCRL-TN-60-658.
Order from OTS $3.00 PB 171 105

This dissertation is intended to be a contribution towards a systematic study of the properties and behavior of radioactive ionization gauges. The chief ionic and electronic processes encountered are briefly reviewed. Then a relationship between the collected ion current and the gas pressure is analytically developed for a planar configuration, considering the probability of electron attachment as a function of the electric field intensity and the gas pressure. In calculating the theoretical current-pressure curves, the numerical values used for ionic mobilities and the recombination coefficient are those derived from kinetic theory; Bloch and Bradbury's theoretical values of electron attachment are used for different mixtures of nitrogen and oxygen. Experimental current-pressure curves are found to be in fair agreement with the theoretical results. It is indicated that the hysteresis phenomenon, sometimes exhibited by ionization gauges, may be caused by: (1) Temperature dependence of the main electronic processes inside the gauge. (2) Variation in the environmental conditions which may result in a change in the composition of one or more of the present electro-negative gases. It is shown that the primary ionization by alpha particles, in a gas of constant density, increases as the temperature decreases. The results led to the design of two radioactive ionization gauges; one uses alpha particles emitted from a radium source as the ionizing agent and the other employs beta particles from a tritium source.

Microwave Associates, Inc., Burlington, Mass.
HIGH POWER C-BAND BEACON MAGNETRON RESEARCH AND DEVELOPMENT PROGRAM. Quarterly progress rept. no. 1, Appendix 1, on Contract DA 36-039-sc-78934. 25 Feb 60, 9p. AD-237 957.
Order from LC mi$1.80, ph$1.80 PB 150 448

Additional information on anode and output design, input assembly, and tuner assembly and mechanism. (See also PB 147 985).

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
THREE-PHASE MAGNETIC MODULATORS, by Edward J. Smith. Rept. on Contract AF 30(602)1619. 7 July 60, 42p. 11 refs. Research rept. R-778-59; PIB-706; RADC-TN-60-168.
Order from LC mi$3.30, ph$7.80 PB 150 875

The polyphase modulator provides a means for obtaining an output pulse-repetition rate which is greater than that of the input a-c frequency by an integral factor. Core iron volume requirements are determined by analysis, and it is found that the size of a three-phase modulator need not be appreciably greater than that of a single-phase line with an a-c source of three times the frequency of the three-phase source. Experimental results on four basic three-phase connections show that all circuits can be made to operate in a stable and balanced manner, yielding three output pulses per cycle having equal amplitudes and interpulse spacing. The effects of phase interaction on required modulator size, stability, and ease of balance are investigated. (Author)

Minneapolis-Honeywell Regulator Co., St. Petersburg Fla.
A DESIGN STUDY FOR A MAGNETOMETER STABILIZATION SYSTEM, by W. J. Beirne. Final rept. Phase 2, 15 Oct 59-29 Feb 60, on Contract AF 19(604)5216. 7 Mar 60, 81p. 2 refs. MH Aero Document R-ED 28030; AFCRC TR-60-263.
Order from LC mi$4.80, ph$13.80 PB 150 931

This report describes the preliminary design of a magnetometer stabilization system. The primary use of the system is to maintain the axes of three Earth magnetic field sensors in a preset azimuth and level orientation during a ten-minute vertical flight of an Aerobee-Hi sounding rocket. Included are a preliminary specification, stating the design aims; a description of the design; the operating procedures, and the design studies which established the mechanical and electrical properties of the hardware. (Author)

National Bureau of Standards, Boulder, Colo.
VHF AND UHF POWER GENERATORS FOR RF INSTRUMENTATION, by A. H. Morgan and P. A. Hudson. Sep 60, 24p. 2 refs. Technical note no. 77.
Order from OTS $0.75 PB 161 578

The work described in this report was undertaken to provide certain projects with a series of fixed frequency rf generators having good stability with respect to both frequency and power output level and continuously adjustable in power output from 1 to 100 watts. Prior to the completion of the generators the work of some of the standards projects was seriously hampered because the rf generators available were lacking in either sufficient power output, frequency stability, or power output stability. For example, bolometer bridges used for rf voltage and power measurements are sensitive to power input variations as small as a few parts in 10^4. Power stability of at least one part in 10^3 is considered an absolute necessity to obtain measurement accuracies of from 0.5% to 1%. (Author)

Naval Research Lab., Washington, D. C.
THE RELATIONSHIP OF A RETINAL-GAIN INDEX TO SYSTEM PERFORMANCE, by S. Seidenstein, R. Chernikoff, and F. V. Taylor. Interim rept. 26 Sep 60, 8p. NRL rept. 5548.
Order from LC mi$1.80, ph$1.80 PB 149 849

In a closed-loop man-machine control system, the relationship between a given system error and the error signal as imaged on the retina of a tracker's eye is determined by (a) the display gain and (b) the viewing distance. The reciprocal of viewing distance can be termed optical gain. Display and optical gains of various values can be combined to yield a single index, namely retinal gain, which indicates the ratio between the error as imaged on the retina and system error. This study investigated the relationship of optical, display, and retinal gain to tracking precision, using a compensatory tracking system. The following results were obtained: Increasing either optical or display gain reduced error. For each value of retinal gain, there was no significant change in error over the range of display and optical gains used. It is concluded that display and optical gains can be combined into a single index, retinal gain, and that this index is systematically related to tracking error. (Author)

Naval Research Lab., Washington, D. C.
A SPIRAL-GRATING ARRAY, by J. R. Donnellan and R. T. Close. 23 Aug 60, 18p. 2 refs. NRL rept. 5499.
Order from LC mi$2.40, ph$3.30 PB 146 395

A problem associated with a two-dimensional spiral doublet array is concerned with the fact that use of the spiral doublet (i.e., two equally excited spirals of opposite sense placed side by side) as an element to obtain linear polarization leads to spacing difficulties, since the distance between elements is always twice as much in one dimension as it is in the other dimension. Thus, the allowable scan is seriously limited in one principal plane. A method is proposed for obtaining linear polarization from a single two-wire spiral antenna (thus eliminating the spacing problem) by using it in combination with a polarization grating and a ground plane. Experimental results were obtained by combining eight of these elements in a one-dimensional array. For the broadside position of the main beam, the field was found to be linear, with the cross-polarized component of the main beam being 40 db down from the principal polarization. As the beam was scanned out to ±45 degrees, the linearity decreased quite rapidly (to approximately 10 db at 45 degrees) and the plane of the linear polarization was rotated; sidelobes were much higher than predicted. Use of this array (rather than an array of doublets) would involve a compromise concerning specifications, dependent upon the particular application of the array. (Author)

Navy Electronics Lab., San Diego, Calif.
BROADBAND SLEEVE ANTENNA FOR OMNIDIRECTIONAL SHORE STATION USE, by W. E. Gustafson, T. E. Devaney, and N. H. Balli. [1954] 12p. 4 refs. Rept. 478.
Order from LC mi$2.40, ph$3.30 PB 152 615

This report released for sale to the public 15 Nov 60.

This report deals with the development of omnidirectional transmitting and receiving antennas for 2.5 to 7.5 Mc, 5.0 to 15.0 Mc, and 7.3 to 22.0 Mc. It also reports the testing of a 2.5-to-7.5 Mc transmitting prototype antenna. It was concluded that omnidirectional antennas of the type developed can reduce the total number of vertical antennas required and/or increase the efficiency of naval shore stations. (Author)

New York U. Coll. of Engineering, N. Y.
AN OPTIMUM SELF-SYNCHRONIZED SYSTEM, by S. S. L. Chang and B. Harris. Scientific rept. no. 1 on Contract AF 19(604)6168. 8 June 60, 52p. 5 refs. AFCRC TN-60-586.
Order from LC mi$3.60, ph$9.30 PB 150 764

Synchronous detection has been often used as the model for the modulation scheme of feedback systems. This report considers the synchronization problem then present. One optimum scheme for transmission in the presence of additive noise is binary PSK using a modified equal-weight Reed Code and synchronous detection. This technique also permits the synchronizing carrier at the receiver to be generated from the message signal itself, so that phase drifts due to multipath and doppler can be automatically and correctly compensated for.

Office of Naval Research, Washington, D. C.
ONR STUDY GROUP ON MICROELECTRONICS. Final rept. June 60, 18p. ONR-7; AD-239 826.
Order from OTS $0.50 PB 161 890

This report released for sale to the public 2 Nov 60.

This report presents the results of a survey and study of the state-of-the-art in microelectronics with particular reference to its implications and impact on the Navy. The Navy has need for improved functional performance, increased reliability, better power efficiency, and decreased size, weight, and cost of electronic equipment and components. Microelectronic techniques and devices are capable of contributing to the satisfaction of all of these needs. The methods of approach to the field can be subdivided into three groups: packaging techniques, integrated circuits, and functional blocks. There is fairly wide-spread developmental activity in the first category, with some actual production of prototype and regular-usage units. Research and development in the second category is being conducted by many industrial concerns and government laboratories, while work in the third category is confined to a small number of research laboratories. The development and adoption of microelectronic devices and techniques is likely to have a profound and wide-spread effect on the electronics industry itself and on electronic equipment and functions. It will make possible functions which are not now capable of being performed, will offer the potential of large increases in reliability, and can achieve reductions of size, weight, and power consumption of very large proportions.

Office of Technical Services, Dept. of Commerce, Washington, D. C.
TRANSDUCERS. Aug 60, 7p. 92 refs. OTS Selective Bibliography SB-428.
Order from OTS $0.10 OTS SB-428

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. This bibliography includes reports added to the OTS collection during the period 1945 to September 1960.

Patterson Moos [Div. Universal Winding Co.] Jamica, N. Y.
RESEARCH STUDY OF THE PHYSICAL AND CHEMICAL REACTIONS OF PRIMARY AND SECONDARY CELLS UTILIZING RADIOACTIVE TRACER ELEMENTS, by John A. DeRosa and Harry C. Lieb. Quarterly progress rept. no. 4 (Final) 16 Jan-15 Mar 53, on Contract DA 36-039-sc-15507. 15 Mar 53, declassified 24 June 58. 51p. AD-10 037.
Order from LC mi$3.60, ph$9.30 PB 150 843

This report released for sale to the public 1 Nov 60.

Radioactive tracer studies of the Zn/KOH/Ag_2O_2 system were conducted with a type-C-1 battery assembly. Electrolytic additives (Versene, zincate) had specific actions on the Zn electrode and increased the corrosion rate of Zn with a consequent shortening of battery life. The presence of appreciable amounts of sulfite lowered battery performance; small amounts of the additive may be beneficial. Deoxygenated electrolyte improved the battery. At high KOH concentrations and low discharge rates and in early stages of stand, the reaction $2Zn + 6OH^- - 2e \rightarrow 2ZnO_2^{2-} + 2H_2O + H_2$ prevailed at the Zn electrode; otherwise the reaction $2Zn + 4OH^- - 2e \rightarrow 2HZnO_2^- + H_2$ predominated. The reaction at the Ag_2O_2 electrode was $Ag_2O_2 + 4e \rightarrow 2Ag + 2O$ with Ag_2O as the intermediate product. Dissolution of Zn was enhanced by higher KOH concentrations up to an optimum value, by a greater volume of electrolyte, and by a greater distance from the Ag_2O_2 electrode. Capacity and storageability were functions of the amount of Zn dissolved, provided that no side reactions occurred at both electrodes. Suggestions for improving the battery include: reducing the KOH concentration to 20 to 25%, increasing the ratio of electrolyte volume to weight of Zn, employing a small amount of antioxidant or a deaerated electrolyte, and using inert, less permeable separators.

Pennsylvania State U., University Park.
PROPAGATION DISTORTION OF BANDS OF LARGE-AMPLITUDE ACOUSTIC NOISE. II. AN EXPERIMENTAL INVESTIGATION OF CERTAIN PLANE WAVE CASES, by Fujio Oda and Eugene Ackerman. Rept. on the Generation, Propagation, Action and Control of Acoustic Energy, Contract AF 33(616)2772. May 60, 31p. 5 refs. WADD Technical rept. 60-233.
Order from OTS $1.00 PB 171 059

The equipment requirements for experimental studies of finite amplitude distortion of bands of noise is compared with similar requirements for pure tone studies. Based on this comparison, the equipment was assembled for noise-band studies including a specially constructed ionophone (corona-type loudspeaker). Frequencies used at the ionophone were in the 15 to 50 kc range. The over-all sound pressure levels were varied from 110 to 135 db re 0.0002 bars. It was possible to verify theoretical predictions for two of the regions described in a previous report. (Author) (See also PB 171 021)

Radio Corp. of America, Camden, N. J.
MICRO-MODULE PRODUCTION PROGRAM. Quarterly rept. no. 8, 1 Jan-1 Apr 60, on Contract DA 36-039-sc-75968. [1960] 169p. 4 refs. AD-241 358.
Order from OTS $3.00 PB 171 126

Prototype tests on microelements and modules and subassemblies were completed. Results of the prototype B tests on a total of 116 capacitor microelements of all required types indicate 10% failures, with 6% failures attributed to high dissipation factors. At the end of the 2000-hr operating life test, 168 capacitor elements including all types had 14% failures of which 8% had high dissipation factors, both before and after the test. The dissipation factors of capacitors increased after assembly into test modules and encapsulation by a predictable amount which is calculable from module design. A considerable number of failures of prototype modules were due to troubles with the terminations rather than the capacitor elements. This problem was resolved in the production of final-grade capacitor elements. A total of 36 wafers each containing 144 resistors showed no failures at the end of the 2000-hr load life prototype test. Resistor performance during B-2 tests was generally good. A revised standard for leads and wafer lands for microelement resistors yielded improved resistors. A lower viscosity encapsulant, Stycast 2651-40, together with new molding techniques and fixtures brought about considerable improvement. In view of these changes and with more rigid quality inspection in effect before assembly and encapsulation, final-grade inductor microelements will exhibit improved quality. (See also PB 161 911)

Radio Corp. of America, Harrison, N. J.
A STUDY OF ELECTRON TUBE DETERIORATION UTILIZING KINETIC THEORY, by E. R. Schrader. Quarterly rept. no. 3 for 1 Jan-1 Apr 60 on Contract NObsr-77637. [1960] 94p. 38 refs. AD-235 319.
Order from LC mi$5.40, ep$16.80 PB 152 753

This report released for sale to the public 16 Nov 60.

The final results of a 2000 hr life test on factory produced 5814-A electron tubes are given in terms of the kinetic deterioration scheme. The resulting activation energy compares favorably with those found in similar tests. A description is given of the life test conditions for a set of specially prepared tubes of this type. The tests on gas evolution from 3 plate materials give activation constants consistent with the values found in the literature when the former are computed on a statistical basis. However, tests on individual samples give scattered results. An improved processing schedule is discussed. Preliminary and background information is given on the sublimation and processing phases. The results of the first determination of electrode, mica, and bulb deposits by use of the x-ray fluorescence technique is tabulated. (Author)

Radio Corp. of America, Lancaster, Pa.
ELECTRON TUBE MATERIALS, GASES, AND GETTERS, by J. C. Turnbull and G. P. Kirkpatrick. Quarterly progress rept. no. 3, 15 Apr-15 July 59 on Contract DA 36-039-sc-78226. 15 Aug 59, 56p. 3 refs. AD-227 616.
Order from LC mi$3.60, ph$9.30 PB 149 707

Methods have been standarized for the determination of thermal outgassing of tube materials: (1) during initial outgassing in which the sample is heated in steps to 1000°C and (2) during extended heating at a lower temperature of 400°C. Initial outgassing measurements are given for nickel, cold rolled low carbon steel, nickel plated steel, nickel coated gas carbonized steel, and tantalum. A method is described for determining getter performance under tube operating conditions at very low pressures and for extended time periods. Results of metallurgical examination of the metal samples being used in the present contract work are presented. (Author)

Ray-O-Vac Co., Madison, Wis.
PAPERLINED MAGNESIUM DRY CELLS AND BATTERIES, by P. F. Albert. Final technical rept. for 2 Apr 57-31 Mar 60 on Contract DA 36-039-sc-73241. 1960, 35p. AD-240 194.
Order from OTS $1.00 PB 171 102

500 Individual cells each of the sizes N, AA, A, B, D and F as well as 300 each of the batteries BA-63, BA-408/U, BA-409/U, BA-414/U, BA-416/U, BA-418/U and BA-422/U types were assembled. 150 Batteries of each type were in-plant tested and performances are reported. The performance figures obtained on the BA-408/U and BA-409/U batteries were generally satisfactory. In the other 5 types of batteries tested the performance was poor with a high incidence of failures. The reasons for this are discussed. (Author)

Raytheon Co., Waltham, Mass.
STUDY OF PLATINOTRON DEVICES. Quarterly rept. no. 4, 1 Aug-1 Nov 59, on QKS779, Contract DA 36-039-sc-78229. [1959] 21p; AD-235 637.
Order from LC mi$2.70, ph$4.80 PB 150 446

The mechanical problem with respect to the cathode support was resolved and one additional tube was constructed for evaluation. Additional data on this tube with respect to coolant flow and cathode emission confirmed the findings in the first tube that these were adequate for the objectives of the task. Some information was obtained on the amount of leakage current present in the tube, and it was determined that at a value of magnetic field one-third that of the operating level leakage current was very low. Additional data was not obtained because of destruction of the tube by an internal arc. Some arching may be expected in processing the tube, and the protector circuit which normally prevents such arching from destroying the tube was not working properly. (Author) (See also PB 147 427)

RCA Defense Electronic Products, Camden, N. J.
MICRO-MODULE PRODUCTION PROGRAM. Quarterly rept. no. 5, 1 Apr-1 July 59 on Contract DA 36-039-sc-75968. [1959] 265p. AD-228 166.
Order from OTS $4.00 PB 171 125

Among the main achievements of the quarter was the receipt of the great majority of prototype micro-elements required for the prototype grade of modules and the initiation of the authorized testing program on these parts. Other accomplishments include the perfecting of multilayer thin film ceramic capacitors of sizable capacitances in wafer form, the design of a hermetic solder-seal for micro-element quartz crystals, completion of the micro-module and modular subassembly heat transfer study relating permissible micro-module power dissipation to the elevation of module temperature above that of the surroundings, and the completion of a number of prototype modules. (Author)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
ON JAMMING SPEECH COMMUNICATION WITH COHERENTLY AMPLITUDE-MODULATED INTERFERENCE, by J. C. R. Licklider, Raymond J. Christman, and Newman Guttman. Rept. on Contract AF 18(600)1219. 13 Oct 57, declassified 23 Jan 59, 23p. 8 refs. AFCRC-TN-57-58; AD-110 090.
Order from LC mi$2.70, ph$4.80 PB 148 972

The problem is to make speech communication unintelligible to an enemy and at the same time intelligible to a friend. This report describes experiments on two possible ways of achieving that goal. (Author)

Sonotone Corp., Elmsford, N. Y.
DESIGN AND MANUFACTURE OF SEALED NICKEL-CADMIUM CELLS OF CYLINDRICAL DESIGN, by Francis J. Alliegro and Herbert Bilsky. Quarterly progress rept. no. 1, 1 Dec 59-29 Feb 60, on Contract DA 36-039-sc-84496. [1960] 58p. 3 refs. AD-239 280.
Order from LC mi$3.60, ph$9.30 PB 150 449

The purpose of this contract is the design and manufacture of 60 engineering test models of each of three sizes of sealed nickel-cadmium cells, viz. 10 A. H., 50 A. H. and 100 A. H. capacity, measured at the five hour discharge rate. Six cells of each of the sizes (10 A. H., 50 A. H., 100 A. H.) are under construction as prototypes. All are of the coiled design, containing paper separator and utilizing flat end-plates. The length to diameter ratio has been determined analytically to provide minimum cell case weight. Positive plates contain cobalt. Exploratory tests show promising results on substitutes for paper separator. Material for construction of cell cycling equipment has been ordered. Designs have been established for domed end plates for cells, and for a 100 A. H. cell incorporating rectangular stack-ups. (Author)

Stanford Electronics Labs., Stanford U., Calif.
THE ANALYSIS AND SYNTHESIS OF NONLINEAR CONTINUOUS AND SAMPLED-DATA SYSTEMS INVOLVING SATURATION, by F. Kurzweil, Jr. Rept. on Contract Nonr-225(24). 30 Nov 59, 103p. 16 refs. Technical rept. no. 2101-1; AD-231 411.
Order from LC mi$5.70, ph$16.80 PB 150 493

This study has been concerned with the analysis and synthesis of saturating systems which are either continuous or discrete. Initially these saturating systems are broken into classes in which the representative member is the physical plant in Jordan normal form. The equations describing the plant are written in terms of its impulse response matrix G(t) and the forcing function m(t)f. The constraint on the forcing function, $|m(t)| \leq 1$, categorizes the system as a saturating system. The optimum saturating system is defined to be that system which returns to equilibrium in minimum time subject to the constraint on the forcing function. The synthesis problem is that of construction of the optimum switching surfaces in n-dimensional space. The method proposed here consists in the construction of a linear region by means of a subspace generator, then the placement of the point x(0) on a boundary of the linear region. Analysis in the sampled-data realm is considerably simpler than in the continuous case since a given sampling period T automatically fixes the lag-time between the physical plant and the tracking subspace generator and places bounds on the quantity $(Dev)_{opt}$. (Author).

Stanford Electronics Labs., Stanford U., Calif.
INVESTIGATIONS OF THE HELITRON OSCILLATOR, by B. P. Israelsen. Rept. on Contract Nonr-225(24). 23 Nov 59, 225p. 13 refs. Technical rept. no. 404-1; AD-232 289.
Order from LC mi$9.90, ph$34.80 PB 150 492

This report describes investigations aimed at providing a better understanding of the helitron. The results of experiments dealing with spurious oscillations are presented. Measurements of backward-wave gain by two different methods are described. A second experimental helitron was constructed, the r-f circuit in this case consisting of two, rather than four, segments, with an internal termination. The beam was injected from a slalom focusing structure. Performance was not as good as obtained with the first helitron. A small-signal field theory based on expansion in normal modes is presented. This theory shows that azimuthal beam bunching, i.e., bunching in the direction of electron motion, is the primary interaction mechanism. A study of space charge effects indicates that one of the two space charge waves grows exponentially, even in the absence of circuit fields. An equation for backward-wave gain is given in which two circuit waves and two beam waves are considered. (Author)

Stanford Electronics Labs., Stanford U., Calif.
A METHOD FOR SOLUTION OF NONLINEAR NETWORK PROBLEMS BY DIGITAL COMPUTERS, by W. F. Gillmore, Jr. Rept. on Contract Nonr-225(24). 30 Dec 59, 183p. 25 refs. Technical rept. no. 2051-1; AD-233 022.
Order from LC mi$8.40, ph$28.80 PB 152 183

Contents:
The evolution of the approximation method
Prony's method
Tuttle's method
Alternate procedures
Calculation by continued fractions
Expansion of a series in a continued fraction
Converting continued fractions to ordinary fractions

Simple approximations
A complete table of approximations
Questions of convergence
Relation to Hilbert space theory
Two special continued fractions
A related linear operator
Eigenfunctions of the linear operator
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Approximate solution of nonlinear differential equations
Nature of the approximation
Calculation of the initial derivatives
Other applications and examples
Digital computer programming
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Analog computer function generators
Approximations from discrete data

Stanford Electronics Labs., Stanford U., Calif.
A MODIFIED FORM OF THE MELLIN TRANSFORM AND ITS APPLICATION TO THE OPTIMUM FINAL VALUE CONTROL PROBLEM, by J. Peschon. Rept. on Contract Nonr-225(24). 3 Nov 59, 152p. 13 refs. Technical rept. no. 2102-1.
Order from LC mi$7.50, ph$24.30 PB 150 823

A common property of the class of control-systems described by linear constant coefficient differential equations is that transients take an infinitely long time to vanish. It is therefore not possible to demand that the output and output derivatives - called the states - of the device to be controlled - called the plant - accurately assume specified values at a specified finite positive time. The class of systems investigated in this report is characterized by the requirement that all the plant states assume a prescribed value at some normalized time 'one'. The linear, time-varying systems investigated in this report have the property of moving the plant to the desired final state in spite of most disturbances and parameter changes. A modified form of the Mellin Transform provides a convenient tool to analyze and synthesize such final-value systems; this transform is applied to time-varying systems in a manner quite similar to the Laplace Transform in linear constant-coefficient systems. In addition to the final-value requirement, it is often desired to make the plant output follow a trajectory which is optimum in some sense. If this optimum trajectory is described by a linear differential equation, for instance an Euler equation, the modified form of the Mellin Transform can be used to synthesize a control-system in which the plant-out approximately follows this optimum trajectory, regardless of the values of the given initial and the desired final states. (Author).

Stanford Research Inst., Menlo Park, Calif.
CORNER-REFLECTOR ANTENNA STUDIES, by W. E. Scharfman. Technical memo. no. 1 on Contract DA 04-200-ORD-674. Sep 59, 39p. 7 refs. SRI Proj. 2231; AD-230 813.
Order from LC mi$3.00, ph$6.30 PB 152 614

This report released for sale to the public 16 Nov 60.

The results of various studies on corner-reflector antennas designed to fulfill specific antenna requirements of the Ballistic Research Laboratory are summarized. The theory of ideal corner-reflector antennas is described and its application to practical antenna designs is discussed. Both linearly polarized and circularly polarized antennas are considered. (Author)

Stevens Inst. of Tech., Hoboken, N. J.
LITERATURE SURVEY ON THE EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIALS, by E. R. Johnson. Rept. no. 9, 1 June-31 Aug 59 on Contract DA 36-039-sc-73146. [1959] 16p. 12 refs.
Order from LC mi$2.40, ph$3.30 PB 149 713

Experimental techniques in studying radiation damage is critically reviewed and the effects of experimental conditions discussed. It is concluded that subminiature tubes will be more susceptible to radiation damage than ordinary tubes. Radiation damage to thin films and field emission cathods is discussed. (Author)

Union Switch and Signal Div., Westinghouse Air Brake Co., Swissvale, Pa.
DRY CIRCUIT TESTS AND TEST EQUIPMENT FOR ACCEPTANCE TESTING OF RELAYS FOR LOW LEVEL APPLICATION, by Earl R. Dubas. Interim engineering rept. no. 7, 1 Apr-30 June 59 on Contract AF 33(600)33403. [1959] 53p. 7 refs. AD-219 750.
Order from LC mi$3.60, ph$9.30 PB 152 796

This report released for sale to the public 17 Nov 60.

Miss-test result pattern: It is questionable that satisfactory reliability predictions can be made based on either relay performance during the first 5400 operations or on a contact resistance charge after a miss-test. Miss-test resistance rejection limits: Of the various miss-test resistance rejection limits used, none proved to be the best for predicting future reliability. At the lowest level, or one ohm, the number of contacts and consequently the number of relays connected in series had to be reduced since the interconnecting wiring became an important factor. Environmental influences: 125°C - At elevated temperatures the number of misses appeared to be slightly less than the number at room temperature. -65°C - No change in the number of contact failures was evident at lowered temperatures. Vibration - Due to weight restrictions of the vibration machine, only one relay at a time could be miss-tested, thus the total quantity of information gained was less and the results less evident. They did, however, indicate that the number of misses should be less particularly at the resonant frequencies of the contact spring numbers. Contact current pulse waveform: The contact current waveforms used were sawtooth, sine and square waves. No significant difference between tests using various waveforms was evident. Mechanical investigation: The mechanical investigation disclosed the probable cause of all contact failures to be particle contamination. (Author)

Varian Associates, Palo Alto, Calif.
LOW NOISE BACKWARD-WAVE AMPLIFIER (VA-191) DEVELOPMENT, by Kenneth R. Evans. Rept. for May 56-Oct 59 on Thermionics and Solid State Electronic Technology, Contract AF 33(616)3521. Mar 60, 64p. 7 refs. WADD Technical rept. 60-199.
Order from OTS $1.75 PB 171 069

This report describes a development program for an X-band, backward-wave amplifier. The history of work is outlined and successes and failures are noted. Design changes during this period are mentioned. The data presented in the form of graphs are taken from the final tube meeting the specifications and developed under this program. Recommendations for further work or investigation are discussed. (Author)

Washington U. [Seattle], Coll. of Engineering.
TRAVELING WAVE ANTENNA WITH BROAD BANDWIDTH, by Rubens A. Sigelmann and Donald K. Reynolds. Technical rept. no. 42 on Contract AF 19(604)4098. June 60, 65p. 12 refs. AFCRC TN-60-581.
Order from LC mi$3.90, ph$10.80 PB 150 457

A non-uniform linear array supporting a traveling wave can provide a radiation pattern which is substantially constant in shape over a large frequency band. It would be possible to realize this constant pattern if the part of the antenna that supports the surface wave remains invariable with the frequency, i.e., the dimensions of the operating part of the antenna are constant when measured in wavelengths. In order to excite such an antenna, a continuous excitation is required. The problems of coupling the exciter to the array have been studied analytically, and are presented in this report. Experimental results have been conducted on a model. The radiation pattern was substantially constant, however some anomalies were noted. (Author).

Ordnance, Missiles, and Satellite Vehicles

Air Force Cambridge Research Center, Bedford, Mass.
ATMOSPHERIC PHENOMENA NOTED IN SIMULTANEOUS OBSERVATIONS OF 1958 δ2 (SPUTNIK III), by J. Aarons and H. E. Whitney, eds. Aug 60, 33p. 5 refs. ERD-TR-60-174.
Order from LC mi$3.00, ph$6.30 PB 152 200

Amplitude and doppler records of the 20-Mcps transmission of 1958δ2 (Sputnik III) were simultaneously made at six radio observatories in Europe. Several distinct phenomena were noted. A sharp decrease in amplitude, which lasted from one-half to one and one-half minutes and was followed by an abrupt return of the signal, occurred at the same time at all stations. This phenomenon has been termed "dropout," although indications of low-level signals were usually present, and is explained as a sudden decrease in transmitter power of the satellite when the satellite passes through a region of high electron flux. Another type of decrease in the signal was attributed to highly localized absorbing or scattering regions. A third phenomenon, recorded by techniques of simultaneous measurements, was observed in the concurrence of scintillating signals at some stations and Faraday rotations at others. The overlap of the propagation path to each station recording the scintillations defines a vertical slab of ionospheric region responsible for the scintillations. The region is about 400 to 600 km in the horizontal plane but includes scale irregularities of less than 1 km. (Author)

Air Proving Ground Center, Eglin AFB, Fla.
OPERATIONAL SUITABILITY TEST OF THE TYPE A-3 FIXED GUNSIGHT SIGHT LINE LEVEL INDICATOR. Final rept. on Proj. APG/TAT/60-A-1. 15 May 52, declassified 5 Nov 53. 21p. AD-16 351.
Order from LC mi$2.70, ph$4.80 PB 152 361

This report released for sale to the public 2 Nov 60.

The indicator was tested on F-84E and F-86E aircraft and in the climatic hangar at temperatures down to -60°F. The indicator was concluded to be operationally suitable with a filter setting of approximately 6.0 in temperatures down to -20°F. It has an elevation error of 1/5 mil as compared to an elevation error of 3 mils for the A-2 sight line level indicator. It was recommended that (1) a polaroid filter with a light contrast comparable to the 6.0 setting be incorporated as an integral part of the instrument, and (2) the level vial and/or its mounting be redesigned so that accurate readings may be obtained at temperatures below -20°F.

Allied Research Associates, Inc., Boston, Mass.
LAUNCHING OF AIRBORNE MISSILES UNDERWATER. PART V. RESTRAINING AN UNSTABLE MISSILE'S RESPONSE TO WAVES, by Theodore R. Goodman. Rept. on Contract Nonr-2343(00). 15 Dec 59, 14p. 4 refs. Document no. ARA-708; AD-229 733.
Order from LC mi$2.40, ph$3.30 PB 152 122

It is shown that the response at the free surface of an unstable missile undergoing a vertical underwater launch does not increase with increasing launch depth, but is restrained for waves whose frequency is above a certain critical value. It is then pointed out that there is a cut-off frequency in a fully-developed confused sea below which no waves exist. Finally there is obtained the degree of instability of the missile such that all frequency components in a fully-developed sea be greater than the critical. Thus, if the design sea state is specified it becomes possible to calculate the degree of instability which can be tolerated in order that the complete response be restrained. By designing according to this criterion, the response to waves may be reduced far below the unrestrained response to other disturbances induced by the sea. (Author)
(See also PB 149 510)

Army Chemical Research and Development Labs., Army Chemical Center, Md.
EVALUATION OF MONONITROPOLYSTYRENE AND DINITROPOLYSTYRENE AS EXPLOSIVES, by George D. Clift and Konstantinos Ablas. July 60, 17p. 6 refs. CRDLR-3009.
Order from LC mi$2.40, ph$3.30 PB 150 664

This report describes the tests conducted in the investigation of mononitropolystyrene and dinitropolystyrene as explosives compounds. The results obtained indicate that mononitropolystyrene can be detonated at approximately 1000 m/sec and that dinitropolystyrene can be detonated at approximately 2000 m/sec. (Author).

Army Ordnance Human Engineering Labs., Aberdeen Proving Ground, Md.
MUZZLE BLAST MEASUREMENTS ON HOWITZER, 105mm, M2A2E2 WITH MUZZLE BRAKE NO. 8, by Howard H. Holland, Jr. Aug 60, 28p. 5 refs. Technical memo. 12-60.
Order from LC mi$2.70, ph$4.80 PB 150 733

Measurements of muzzle blast were made primarily to determine the peak overpressures produced. Measures of positive impulse and duration of positive phase were also made. The howitzer was fired at elevations of 1°14', 35°0', and 70°0' with 2 propelling charges: Charge Zone No. 10 (7.22 oz. of T34 and 3.75 lbs. of M17) and 115% of maximum rated pressure (7.22 oz. of T34 and 4.00 lbs. of M17). Some of the overpressures measured were high enough to rupture unprotected human eardrums. It is recommended that attempts be made to lower the peak overpressure below 4 psi. If this criterion is not met, ear protection should be mandatory. (Author).

Army Signal [Research and Development Lab] Fort Monmouth, N. J.
A NOMOGRAM FOR THE SOLUTION OF THE RAPID SURVEY PROBLEM, by Philip Marsh. 11 Mar 57, 25p. 1 ref. Technical memo. no. M-1870.
Order from LC mi$2.70, ph$4.80 PB 150 684

An alignment chart or nomogram has been developed by means of which the computations necessary to the solution of the Rapid Radar Survey Problem can be performed easily and well within the accuracy requirements of the system. With the use of this nomogram, orientation angle can be determined to within three mils and parallax to within twenty yards. Rand-McNally and Company has prepared the nomogram. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ATTENUATION OF AIR SHOCK WAVES IN TUNNELS, by Robert O. Clark and George A. Coulter. June 60, 19p. 11 refs. Memo rept. no. 1278; DASA rept. no. 1176; AD-241 878.
Order from LC mi$2.40, ph$3.30 PB 150 957

The attenuation of peaked shock waves as a function of travel distance along straight, smooth-walled tunnels of constant cross-section is discussed. A theory is presented describing the attenuation as a function of the rarefaction overtaking the shock front. A theoretical attenuation curve and experimental data are presented for a pressure ratio of 5. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
CHANGES IN DRAG CAUSED BY AIR BLAST SHIELDING, by George A. Coulter and William T. Matthews. June 60, 31p. 6 refs. Memo. rept. no. 1279; DASA rept. no. 1157; AD-241 504.
Order from LC mi$3.00, ph$6.30 PB 150 454

An unshielded rectangular target model was exposed to air blast loading in the BRL 24-inch Shock Tube in an overpressure range of 5 to 30 psi. Average pressure loadings over each of the front and rear surfaces of the target model were measured. These values were compared with those obtained when two- and three-dimensional rectangular shields were placed upstream from the target model. Changes in air blast loading on targets caused by the presence of shields are presented as a function of the dimensions of the shields and their distances upstream from the target model. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
STATIC ACCURACY TESTS OF THE RBL SHAFT ANGLE DIGITIZER, by Charles W. Lyle. July 60, 13p. Technical note. no. 1313.
Order from LC mi$2.40, ph$3.30 PB 150 329

Static field tests of the BRL Shaft Angle Digitizer were carried out with the instrument mounted on the azimuth axis of a tracking telescope (RT-1). A wild T-3 theodolite was used as the standard for calibration. The S.A.D. was found to be accurate to its least count of 0°.001. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
STUDY OF HYPERVELOCITY MICRO-PARTICLE CRATERING, by L. G. Richards and L. S. Holloway. June 60, 28p. 12 refs. Memo. rept. no. 1286.
Order from LC mi$2.70, ph$4.80 PB 150 959

A ballistic projection technique capable of accelerating clusters of 10-to 100-micron particles to velocities of 12.0 Km/sec is described. The problem of associating discrete particles from these clusters with the corresponding craters resulting from target impact is considered. For cast iron particles a prevalence of certain sizes in the fragments recovered is related to a corresponding size distribution of the craters in a specific target material. A particle mass responsible for a definite size of crater is thus obtained. The resulting values are correlated with similar data for larger particles at lower velocities. Scaling laws are found to hold over a size range of seven orders of magnitude. (Author).

Cryogenic Engineering Lab., Boulder, Colo.
CRYOGENIC MATERIALS DATA HANDBOOK. Quarterly rept. no. 6 on Contract AF 04(647)59-3. 15 Sep 60, 87p.
Order from OTS $2.25 PB 161 093-5

See also PB 161 093-4

Diamond Ordnance Fuze Labs., Washington, D. C.
MEASURING THE ELECTRIC CHARGE ON A MISSILE IN FLIGHT, by Philip Krupen. 1 Aug 60, 15p. 2 refs. TR-856.
Order from LC mi$2.40, ph$3.30 PB 149 547

There is considerable interest in the electric charge resident on missiles and satellites in flight. An electrostatic field meter is described for measuring the charge. It consists of stationary pickups over which a sectored disk rotates. An alternating voltage is generated at the pickups as they are alternately

covered and exposed at a uniform rate. The magnitude of the voltage is proportional to the electric charge. The sensitivity of the meter and the relationship among the various electrostatic quantities are developed. When the meter is mounted on a vehicle, the charge information can be telemetered to the ground. Some test results are given. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF A THIRTY-SECOND DELAY SWITCH, by Martin Gilford and Burton Werbel. Oct 60, 9p. 5 refs. Technical notes no. FRL-TN-12.
Order from LC mi$1.80, ph$1.80 PB 148 662

A prototype item has been developed which makes use of the Atlas Powder Company delay squib switch mechanism and a delay gas-generator assembly. This combination provides a nominal 30-second interval between squib initiation and activation of the switch mechanism. The delay composition used contained 58% barium chromate, 32% potassium perchlorate, and 10% tungsten. The switch proper was operated by pressure developed upon ignition of a gas-generating composition (lead mononitro-resorcinate 95%, potassium chlorate 5%). No relay material was found necessary between the delay column and the gas-generating composition. The parts used in the prototype item were a modified 4-second M112 fuze housing with relay cup and an experimental squib holder. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF COATED CLOTH FOR MORTAR PROPELLANT INCREMENT BAGS, by Sydney Axelrod. Aug 60, 11p. 2 refs. Technical rept. 2703.
Order from LC mi$2.40, ph$3.30 PB 148 914

Acrylic cloth was coated with a polyethylene latex containing ammonium perchlorate. The coated cloth could not be heat sealed. It is believed that the salt prevented the plastic from forming a strong bond. With locally available equipment, a satisfactory combustible coating could not be deposited on mortar increment bag cloth. Work was discontinued because of lack of funds. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
ELECTROSTATIC SENSITIVITY OF BARIUM CHROMATE/BORON COMPOSITIONS, by Anthony F. Taschler and Edward E. Jones. Oct 60, 9p. Technical notes no. FRL TN-3.
Order from LC mi$1.80, ph$1.80 PB 149 960

Electrostatic sensitivity tests were conducted on 90/10 and 95/5 barium chromate/boron mixtures, both with and without 1% added VAAR. The following joule level results were obtained: 90/10 barium chromate/boron, 0.0023; 90/10/1 barium chromate/boron/VAAR, 0.0315; 95/5 barium chromate/boron, 0.0270; and 95/5/1 barium chromate/boron/VAAR, more than 14.850. The 95/5/1 mixture did not ignite even at the highest joule level obtainable with the equipment used. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
EVALUATION OF 1.5 INCH CANADIAN PLASTIC SIGNAL CARTRIDGE CASE, by Bossie Jackson, Seymour M. Kaye, and Garry Weingarten. Aug 60, 21p. 2 refs. Technical notes no. FRL-TN-2.
Order from LC mi$2.70, ph$4.80 PB 150 825

Static and ballistic performance tests were conducted on 1.5-inch plastic signal cartridges which had been subjected to a group of conditioning tests. The cartridges were supplied by T. W. Hand Fireworks Co., Ltd, Ottawa, Canada. The tests included JAN cycling, vibration-transportation, rough handling, water immersion, and high- and low-temperature conditioning. Test results indicated that the plastic signal cartridges had failed to withstand the JAN cycling, water immersion, and high temperature (167°F) conditioning tests. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
INFLUENCE OF WATER ON THERMAL DECOMPOSITION OF ALPHA LEAD AZIDE, by Bruno Reitzner. Sep 60, 17p. 14 refs. Technical rept. FRL-TR-5.
Order from LC mi$2.40, ph$3.30 PB 148 916

Thermal decomposition of alpha-$Pb(N_3)_2$ at 240°C under moist nitrogen is characterized by pronounced induction periods. The reduction of the aqueous tension, either by reaction with $Pb(N_3)_2$ or by adsorption in hygroscopic liquids, accelerates the decomposition, yielding lead as the final product. The acceleration stage can be suppressed by an aqueous tension greater than 8.9 mm Hg; a hydrolysis reaction then predominates. HN_3, which is formed during hydrolysis, is partially decomposed to give N_2 and NH_3, which react with excess HN_3 to form NH_4N_3. An explanation for the long induction periods found with alkali and alkaline earth azides is proposed. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
SILVER ACETYLIDES, by Virginia D. Hogan and Saul Gordon. Aug 60, 12p. 34 refs. Technical rept. FRL-TR-3.
Order from LC mi$2.40, ph$3.30 PB 150 970

The history of research on the three compounds that can be prepared from silver nitrate and acetylene--Ag_2C_2, $Ag_2C_2 \cdot AgNO_3$, and $Ag_2C_2 \cdot 6\,AgNO_3$--is traced in detail in this report, on the basis of a comprehensive literature survey compiled by the authors. Experimental work was also done, in which the three compounds were subjected to differential thermal analysis both at ambient pressures and at reduced pressures simulating high altitudes of up to 150,000 feet. The explosion temperatures of the feebly explosive compounds Ag_2C_2 and $Ag_2C_2 \cdot 6\,AgNO_3$ (138°C and 300°C, respectively) were found to be substantially unaffected by reduced pressures. However, $Ag_2C_2 \cdot AgNO_3$ exploded violently at 245°C under ambient pressure, and at 195°C at a pressure of one millimeter of mercury. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.

USE OF RADIOACTIVATED METAL DISCS FOR HYPERVELOCITY TRACER STUDIES, by Samuel Helf, Eric N. Clark and others. Aug 60, 12p. 4 refs. Technical rept. FRL-TR-11.
Order from LC mi$2.40, ph$3.30 PB 148 225

The use of radioactivated discs of aluminum and steel to estimate fragment erosion in solid targets for the determination of hypervelocities was found feasible. Activation was accomplished with a slow-neutron flux of 8×10^{12} nvt, in 3 days for the aluminum discs used (4 grams, 1 inch diameter x 1/8 inch thick), and in 4 hours for the steel discs (5 grams, 1 inch diameter x 1/16 inch thick). Gamma ray spectrometry indicated the presence of both Fe^{59} (half life 46 days) and Cr^{51} (half life 28 days) in ratios of 0.5 for the aluminum and 1.3 for the steel. The radioactivities in the aluminum arose solely from impurities, whereas in the steel they were contributed by the major component, iron, and only supplemented by the chromium impurity. The radioactivity was found by successive acid solution determinations to be distributed evenly in both metals. Experimental firings of the tagged discs with Comp B into polyurethane indicated that the mass of a fragment can be estimated by measuring the total radioactivity of the eroded portion of it left in the target material. Aluminum fragments were found to erode 10% and steel 2%. A narrow pipe filled with foamed polyurethane was found to be the best method of minimizing the dispersion of radioactivity. The ablation of the discs in air was measured by firing them through a pipe and catching the eroded radioactive material on absorbing material lining the pipe. (Author)

Illinois U., Urbana.

HYDROBALLISTIC CALCULATIONS OF THE RISE AND WATER EXIT OF BUOYANT BODIES, by J. M. Robertson. Rept. on Contract Nonr-1834(10). Nov 59, 71p. 20 refs. T. & A. M. rept. no. 153; AD-230 259.
Order from LC mi$4.50, ph$12.30 PB 150 831

Problems associated with the vertical rise and passage through a water-air interface of small buoyancy-propelled bodies are considered. In general the methods of analysis are approximate. Calculations are limited to consideration of prolate ellipsoids and usually to those of fineness ratio equal to 4. The terminal velocity and length of rise distance required to approach the velocity closely are calculated. Comparison with experiment indicates fair agreement. Above a diameter of 2 in., the Froude number no longer increases appreciably with body size. A rough analysis of the added-mass variation of ellipsoidal bodies as they pass through the the free surface is developed. This estimate is used to indicate the expected velocity and acceleration changes of exiting bodies, and is shown to diverge somewhat from those found experimentally. Besides the effect of added-mass variation, buoyancy and drag changes as the body exits are also shown to have an important effect on the velocity-distance and acceleration-distance profiles. The effect of entrained water is considered. Calculations of the displacement volume of the boundary layer on the body are shown to be in fair agreement with the measured entrained-water volumes. (Author)

Illinois U., Urbana.

TRANSITION STIMULATION FOR TERMINAL VELOCITY REDUCTION IN WATER-EXIT STUDIES, by J. M. Robertson, J. C. F. Chow, and M. E. Clark. Rept. on Contract Nonr-1834(10). Nov 59, 31p. 12 refs. T. & A. M. rept. no. 152; AD-230 258.
Order from LC mi$3.00, ph$6.30 PB 150 830

A technique for reducing the terminal velocities of small buoyant bodies rising through water is described and its experimental verification indicated. Sand-grain patches to induce premature transition of the flow in the boundary layer from laminar to turbulent were used in the (length) Reynolds-number range of 10^5 to 10^6. A method of designing the sand patches in terms of known information on transition, roughness effects, and laminar boundary-layer growth is detailed. Experimental evidence of the achievement of transition stimulation in an air tunnel, via hot-wire anemometer boundary-layer studies and drag tests, is presented. Finally, it is shown that an appreciable reduction in terminal velocity was obtained in the actual water-exit tests. (Author)

Institute of Metals and Explosives Research, U. of Utah, Salt Lake City.

FUNDAMENTAL INVESTIGATIONS OF HIGH EXPLOSIVES AND HIGH EXPLOSIVES PHENOMENA, by T. K. Collins. Final rept. on Contract N7onr-451(07). 30 Sep 59, 32p. 99 refs.
Order from LC mi$3.00, ph$6.30 PB 150 747

General subheadings of subject matter covered by the investigations are (1) chemical reaction rates in detonation, (2) thermo-chemistry of high explosives, (3) curvature of the detonation wave front, (4) instrumentation for high explosives testing, (5) wave shaping techniques and applications, (6) equations of state in detonation, (7) metalized explosives systems, (8) explosives with inert additives, (9) isothermal decomposition of explosives, (10) adiabatic decomposition of explosives, (11) theory of detonation, (12) shaped charged studies, (13) time lag for initiation of detonation through air, glass, and steel, (14) detonation velocity transients, (15) interaction of detonation waves with metal burdens, and (16) X-ray technique for measuring density vs distance relationships in detonating explosives.

Lincoln Lab., Mass. Inst. of Tech., Lexington.

ON THE LINEAR SMOOTHING OF REDUNDANT RADAR DATA FROM SATELLITES, by Fred C. Schweppe. Rept. on Contract AF 19(604)5200. 25 Aug 60, 58p. 22 G-0021.
Order from LC mi$3.60, ph$9.30 PB 150 799

Linear smoothing procedures for processing redundant satellite radar returns with a digital computer are discussed. Procedures based on polynomial approximations to the orbit in the presence of noise are analyzed and the optimum degree of polynomial is considered. Computer implementation procedures for the actual smoothing are outlined. A few implications of the change in the noise character which results from a transformation from radar coordinates to cartesian coordinates are discussed. Advanced linear filters which do not use a polynomial approximation are presented in general terms, and an upper bound on their capabilities is given. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
TRAJECTORY OF A VEHICLE DEPARTING FROM A CIRCULAR ORBIT, by Ralph B. Bowersox and David Carter. July 60, 41p. 10 refs. LMSD-703049.
Order from LC mi$3.30, ph$7.80 PB 150 886

Numerical solutions for the two-body equations of motion have been obtained by means of a digital computer for the case of a rocket departing from an initial circular orbit with constant thrust and flow rate. Thirty solutions have been obtained in a wide range of thrust magnitudes, specific impulses, and thrust directions. One solution was obtained for an initial elliptical orbit and another for a small negative thrust as might be used in a landing maneuver. The data have been compared with solutions for other thrust programs. An approximation has been derived to describe the trajectories in terms of the variations in the orbital parameters. At either high or low specific thrust values, a circumferential thrust gives as high a mass ratio at escape (m_f/m_o) as does a tangential thrust program. At intermediate specific thrust values, the tangential thrust is more effective. For all the positive low thrust examples, the eccentricity of the osculating ellipse tends to remain near zero (and actually decreases to zero from the initial elliptical orbit) until the vehicle is near escape. Thus, the circular orbit appears to possess a special stability when it is being expanded, but the opposite is true for negative thrust, in which case the trajectory becomes very eccentric. (Author)

McCrone, Walter C., Associates, Chicago, Ill.
THE CRYSTALLOGRAPHY OF EXPLOSIVES. PHASE I. CRYSTAL STRAIN IN LEAD AZIDE. PHASE II. CRYSTAL STRUCTURE OF EXPLOSIVES, by W. C. McCrone, John A. Reffner and L. V. Azaroff. Quarterly rept. no. 1, 12 May-31 July 60, on Contract DA 11-022-ORD-3412. 12 Aug 60, 21p.
Order from LC mi$2.70, ph$4.80 PB 152 062

A method for the continuous isothermal crystallization of well formed clear crystals of alpha lead azide is described. Crystals grown with this apparatus are to be used as seed crystals in a series of experiments designed to test the hypothesis that strain in beta lead azide can cause spontaneous detonation. The experimental arrangement for carrying out these experiments has been constructed and preliminary experiments have begun. The crystal structure of normal lead azide will have to be tackled in an indirect manner because the scattering by the lead atoms completely blankets the contribution of the individual carbon, hydrogen, oxygen and nitrogen atoms. Thus far no other styphnate isostructural with lead styphnate has been found. However, two isostructural styphnates, those of potassium and of ammonium, have been prepared in suitable crystals and structures of these two crystals is well under way. (Author)

Melpar, Inc., Watertown, Mass.
RECOGNITION OF OBJECTS IN SPACE FROM DYNAMIC TRAJECTORY DATA, by Arthur L. Levine. Scientific rept. no. 1 on Contract AF 19(604)5996. Aug 60, 134p. 1 ref. AFCRL-TN-60-966.
Order from LC mi$6.90, ph$21.30 PB 150 989

Included are the equations of motion of a space object moving in a central force field as observed from a point on a rotating spherical earth, equations necessary to calculate a set of orbital parameters for two different minimum sufficient sets of observed data, equations describing the sensitivity of orbital parameters to variations in observed data, and equations describing the variations in orbital parameters due to variations in the force field on the body. (Author)

Naval Ordnance Lab., Corona, Calif.
FUSED SALT VOLTAIC CELLS. AN ANNOTATED BIBLIOGRAPHY OF THE TECHNICAL LITERATURE CONCERNING CELL POTENTIALS, comp;. by W. C. Spindler and R. E. Panzer. 31 July 59, 41p. 85 refs. NOLC rept. 457; NAVORD rept. 5957; AD-225 203.
Order from OTS $1.25 PB 171 114

An annotated bibliography is presented of 85 articles pertaining to electrochemical cells utilizing fused salt electrolytes, with particular application to energy-producing voltaic cells. The literature cited includes material on electrode potentials and electrode reactions in both voltaic and electrolytic cells; it does not include references to the physical and chemical properties of fused salts. (Author)

Naval Ordnance Test Station, China Lake, Calif.
MICROSCOPICAL INVESTIGATION OF PLASTISOL NITROCELLULOSE, by John W. French. 5 Apr 60, 19p. NOTS TP 2497; NAVWEPS rept. 7086.
Order from LC mi$2.40, ph$3.30 PB 150 456

A description of plastisol nitrocellulose (PNC) is given for both the macroscopic and microscopic appearances and is supplemented by several optical- and electron-microscope photomicrographs. Also, a brief descrption is given of the materials and techniques used in this investigation. The average particle size of different PNC lots is determined by various means, and the results are tabulated and discussed. The methods and results obtained on curing the solution of PNC in pentaerythritol trinitrate (petrin), a plasticizer, at elevated temperatures are described and illustrated with suitable charts and photomicrographs. (Author)

Naval Weapons Lab., Dahlgren, Va.
TERRIER BOOSTER WATER QUENCH VALVE FOR STOWAGE SAFETY, by H. V. Yarus. 15 Sep 60, 20p. 6 refs. NWL rept. no. 1722.
Order from LC mi$2.40, ph$3.30 PB 150 626

The booster quench valve, developed by the Naval Weapons Laboratory for Terrier ready-service magazines, is an automatic, mechanically operated valve which allows water to be injected into an accidentally ignited booster at the beginning of burning. The design makes use of experience gained in developing a similar valve for the Tartar systems. The design also considers the initial burning characteristics of the Terrier booster, and the original contract specifications for Terrier quench valves. The valve consists of 25 separate parts including seals, screws and mount. An analysis of the Terrier valve design indicates that it is several times more sensitive than the Tartar valve, and that it functions extremely rapidly in the exhaust environment of a Terrier booster. Analysis

also indicates that the Terrier valve will meet the specification and environmental requirements. (Author)

Paris U. (France).
DOPPLER MEASUREMENTS ON ARTIFICIAL SATELLITES, by Etienne J. Vassy. Technical note for 1 Apr 59-31 Mar 60 on Contract AF 61(052)155. [1960] 32p. 30 refs. ERD-TN-60-773.
Order from LC mi$3.00, ph$6.30 PB 150 647

A device for measuring the Doppler shift of the artificial satellites has been realized. For this purpose, the time pips and the signals of the satellite, whose frequency varies as the Doppler effect, are, both, recorded on a double track magnetic tape. This frequency is then measured by comparing it with an independent LF oscillator by means of Lissajous ellipses. The position of the inflection point of the curve and the gradient of the tangent at this point are determined by a grapho-analytical method. (Author)

Temple U., Philadelphia, Pa.
HIGH VELOCITY IMPACT STUDIES DIRECTED TOWARDS THE DETERMINATION OF THE SPATIAL DENSITY, MASS AND VELOCITY OF MICROMETEORITES AT HIGH ALTITUDES, by J. Lloyd Bohn and Otto P. Fuchs. Scientific rept. #1 on Contract AF 19(604)1894. 31 Jan 58, 53p. 8 refs. AFCRC-TN-58-243; AD-152 478.
Order from LC mi$3.60, ph$9.30 PB 150 925

Since no measuring instruments are available whose indications represent a known function of the mass (m) and the velocity (v) pertaining to impacts, the paper discusses the particular problem of the development of analytical expressions describing the impact processes.

Watertown Arsenal Labs., Mass.
METALLURGICAL OBSERVATIONS OF HIGH VELOCITY IMPACT, by K. H. Abbott. Sep 60, 23p. 8 refs. Technical rept. no. WAL TR 161.85/1.
Order from OTS $0.75 PB 161 800

Annealed 1020 steel, hardened FXS-318 steel, and 2024-T4 aluminum alloy pellets with length-to-diameter ratios of 1.25 were fired at standard steel armor, aluminum armor, and 301 stainless steel plates at velocities from 2,000 to 13,000 fps. Plate sections containing crater half-sections were subjected to hardness, macrostructure and microstructure measurements to determine metallurgical phenomena which influence crater formation. Dynamic instabilities resulting in slip with the formation of transformed untempered martensite on maximum shear planes were observed in the standard steel armor. The number of these shear bands with associated cracking increased with increasing pellet velocity. Slip without transformation was observed in both the aluminum alloy and stainless steel plates. No local transformation from austenite to martensite was observed in the stainless steel. Extensive hardening in the vicinity of the crater was measured in all plate materials. (Author)

Ship Building

David Taylor Model Basin, Washington, D. C.
DYNAMIC LOADING OF A MOTOR TORPEDO BOAT (YP 110) DURING HIGH-SPEED OPERATION IN ROUGH WATER, by Norman H. Jasper. Sep 49, 36p. 10 refs. Rept. C-175.
Order from LC mi$3.00, ph$6.30 PB 152 797

This report released for sale to the public 18 Nov 60.

Pressures and strains were measured on the hull of a motor torpedo boat (YP110, Ex PT8) during rough-water operation in order to establish design criteria for hull plating and local structure. The most severe loading due to wave forces occurred between the forward quarterpoint and the midship section. The highest maximum effective pressure for this boat was 36 psi. In order to determine the effective pressures the solution is given for the damped response of a single-degree-of-freedom system to a modified blast pulse. Failure of portions of the hull structure during these tests indicated that previous design specifications were inadequate. In this report are proposed criteria for designing structures of sufficient local and overall strength to withstand severe dynamic loading of the type encountered in rough water. Recommendations for further research are made. (Author)

David Taylor Model Basin, Washington, D. C.
A PROCEDURE FOR COMPUTING STRESSES IN A CONICAL SHELL NEAR RING STIFFENERS OR REINFORCED INTERSECTIONS, by Richard V. Raetz and John G. Pulos. Apr 58, 36p. 8 refs. Rept. 1015.
Order from LC mi$3.00, ph$6.30 PB 152 807

This report released for sale to the public 18 Nov 60.

A second approximation to the complete theory for the axisymmetric deformations of thin elastic conical shells, as derived by E. Meissner and F. Dubois, is presented. This simplification of the exact differential equation leads to a so-called Geckeler-type approximation for conical shells. From this approximation, a step-by-step numerical procedure is developed for calculating stresses and strains throughout the conical elements of shell structures, The methods include computation of the edge shearing forces and bending moments which arise from discontinuity effects at cone-cone and cone-cylinder junctures, either with or without transverse reinforcing rings. The range of applicability of the approximation is also discussed. (Author)

David Taylor Model Basin, Washington, D. C.
A SURFACE-ROUGHNESS PROFILOMETER, by F. B. Miller. Sep 60, 9p. Rept. no. 1347.
Order from LC mi$1.80, ph$1.80 PB 150 459

This report describes a surface-roughness profilometer device capable of recording the outline of a section of a surface of structures such as ships' hulls. The full-scale range of the system is ±0.015 inch around a chosen zero level. The recording is made on magnetic tape, and upon playback, is available in electrical analog form; thus conventional wave analyzers may be used for analysis. The recording system is designed around a vehicular-type tape recorder, and is small and compact for field use. (Author)

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Arctic Aeromedical Lab., Ladd AFB, Alaska.
ARCTIC SURVIVAL RATIONS. V. EFFECT OF PROLONGED CONSUMPTION OF PEMMICAN SURVIVAL RATION ON SOME ASPECTS OF THE INTERMEDIARY METABOLISM OF RAT LIVER TISSUE, by John P. Hannon and David A Vaughan. July 60, 26p. 22 refs. Technical rept. 57-55.
Order from LC mi$2.70, ph$4.80 PB 150 571

The effect of prolonged feeding (3 to 5 months) of pemmican meat bar on some aspects of the in vitro metabolism of liver tissue was investigated. The endogenous metabolism of liver slices and homogenates was significantly increased by pemmican. This increase was very probably due to an increase in the amount of easily metabolizable substrate within the tissue of these animals. Utilizing mitochondrial preparations, it was found in the absence of added cytochrome-c and diphosphopyridine nucleotide that with all substrates studied except glutamate, α-ketoglutarate, and succinate, the respiratory rate was not affected by the previous diet. The three substrates mentioned were oxidized at significantly lower rates in the pemmican group. Upon the addition of cytochrome-c and diphosphopyridine nucleotide, the qO_2 of glutamate, α-ketoglutarate, and succinate was returned to the normal value. It was concluded on the basis of the present measurements that prolonged feeding of a high-fat protein diet such as that found in the pemmican meat bar results in no obvious deleterious effects insofar as the intermediary metabolism of rat liver tissue is concerned. (Author) (See also PB 144 850)

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Brown U. Div. of Engineering, Providence, R. I.
A TENSION-TORSION MACHINE FOR BI-AXIAL CREEP TESTING, by A. Shelton. Technical rept. no. 1 on Contract Nonr-562(20). Nov 59, 14p. 1 ref. AD-229 94
Order from LC mi$2.40, ph$3.30 PB 150 868

A tension-torsion machine is described which was designed for both short- and long-term creep tests at room and at elevated temperatures. The machine, constructed almost entirely of Al, is essentially a constant-load device which relies on the application of dead weights at the ends of levers to induce a tensile load and/or torque on the test specimen. The loads and torques are determined from resistance strain-gages applied to calibrated bars. The maximum capacity of the machine is 6 tons tension and 2 ton-in. torque. A simple muffle furnace was designed for tests at elevated temperatures.

Sundstrand Turbo Div., Sundstrand Corp. [Pacoima, Calif.]
STUDY OF TURBINE AND TURBOPUMP DESIGN PARAMETERS. VOLUME IV. LOW SPECIFIC SPEED TURBOPUMP STUDY, by Kenneth E. Nichols, Donald G. McPherson, and O. Eric Balje. Final rept. for 6 Oct 58-31 Oct 59 on Contract Nonr-2292(00). Nov 59, 241p. 27 refs. S/TD-1735; AD-232 638.
Order from LC mi$11.10, ph$37.80 PB 150 834

An investigation of maximum efficiencies of low specific speed turbopumps obtainable with the present state of the art is covered. Optimum suction specific speed and optimum efficiency are analyzed and a theoretical method of determining the detailed design criteria for each optimum design performed. Experimental evidence was accumulated to substantiate the analysis and the final design parameters are presented as functions of pump specific speed and specific diameter. (Author).

Engines and Propulsion Systems

Aerojet-General Corp., Azusa, Calif.
UTILIZATION OF UPPER-ATMOSPHERE ATOMIC-OXYGEN RECOMBINATION FOR PROPULSION, by A. Zukerman and C. B. Kretschmer. Rept. on Contract AF 49(638)111. 10 Apr 59, 91p. 15 refs. Aerojet-General TN-28; AFOSR TN-59-517; AD-216 292.
Order from LC mi$5.40, ph$15.30 PB 152 055

The report presents a preliminary investigation of several methods for the utilization of the upper-atmosphere atomic-oxygen recombination energy for propulsion purposes. The following systems were studied: (1) the fuelless ramjet, (2) a ramjet with fuel addition, and (3) a catalytic ram rocket (a power plant of the ramjet type in which the chemical reaction takes place primarily on the catalytic surfaces of the reaction chamber). The fuelless ramjet cycle was previously investigated using ideal conditions. In this investigation, losses were taken into account and the latest available values for the reaction-rate constant were used. This investigation shows that the fuelless ramjet cannot provide enough thrust to sustain a satellite in the atomic-oxygen layer. The investigation of the ramjet with mass addition shows that with fuels similar to NO_2 (in molecular weight and heat release) enough thrust can be derived to overcome the external drag, but not the total drag. Certain configurations of the catalytic ram rocket show promise for sustaining a satellite for a considerable length of time at a high expense of coolant fluid. (Author)

Avco-Everett Research Lab., Mass.
ANALYSIS OF CONSTANT VELOCITY PULSED PLASMA ACCELERATOR, by Z. J. J. Stekly. Rept. on Contract AF 49(638)659. July 60, 21p. 5 refs. Research rept. no. 89. AFOSR-TN-60-935.
Order from LC mi$2.70, ph$4.80 PB 150 964

The equations are set down in a dimensionless form for a constant velocity pulsed plasma accelerator, treating the accelerator as a circuit element. The equations are solved in closed form and plots of voltage, current, gas energy and required mass distribution are obtained. It is shown that circuit inductance both reduces and delays the energy transfer from the capacitors to the gas. A typical design for a constant velocity pulsed plasma accelerator is obtained making use of the dimensionless plots obtained as a result of the analysis. (Author).

Avco-Everett Research Lab., Mass.
MAGNETOHYDRODYNAMIC PROPULSION, by G. Sargent Janes. Rept. on Contract AF 49(638)659. Aug 60, 71p. 9 refs. Research rept. no. 90; AFOSR TN 60-955; AD-243 117.
Order from LC mi$4.50, ph$12.30 PB 150 777

The morphology of plasma propulsion devices is presented following a brief discussion of the requirements for mission objectives. The two criteria employed for this classification are field-current configurations and containment. Containment is essential for efficiency and probably represents the primary area requiring further research. Both aerodynamic and magnetic containment are considered. The various categories of electrical motors are completely analogous to the categories of field-current configurations. Three specific examples of devices being studied at AERL are presented together with a qualitative discussion of the basic physical principles necessary for their understanding. (Author)

Bell Aerosystems Co., Buffalo, N. Y.
OBSERVATION OF PROPELLANTS INJECTED INTO A FIRING ROCKET CHAMBER, by Theodor G. Rossmann. Rept. on Contract AF 49(638)260. 1 July 60, 58p. 13 refs. Rept. no. 8007-981-011; AFOSR-TR-60-98; AD-243 514.
Order from LC mi$3.60, ph$9.30 PB 152 039

Various liquids were injected into a firing windowed rocket chamber to check and, if necessary, to supplement existing theories dealing with evaporation rates of droplets, as to their applicability to conditions existing in rocket combustion chambers. The resulting droplets were photographed by means of an experimental technique especially developed for this purpose, which provides a succession of magnified shadow pictures of the liquid core of the droplets traveling in the combustion gases. The present report describes experiments with liquids heated before injection in an attempt to obtain measurable evaporation rates of droplets larger than 100 microns. The windowed motor technique has been utilized for investigations concerning the effect exercised on the injection pattern by disturbances introduced into the feed system, such as transient or periodical pressure pulses.

Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.
A SURVEY OF CYCLOIDAL PROPULSION, by Charles J. Henry. Rept. on Contract Nonr-263(27). Dec 59, 30p. 13 refs. Rept. no. 728; AD-230 866.
Order from LC mi$2.70, ph$4.80 PB 152 130

A brief history is presented of cycloidal propulsion and a description of the kinematics of the flow through a cycloidal propeller. The various types of cycloidal propellers are discussed and a description of several installations is presented. A survey is presented of the literature pertaining to theoretical design procedures used for cycloidal propellers. A comparison of cycloidal and screw propulsion shows that cycloidal propeller efficiency is in the range 0.45 to 0.58 as compared to 0.66 to 0.76 for screw propellers. Some advantages of cycloidal propulsion are discussed. In order to insure optimum efficiency in designs of the future, it is recommended that research be carried out to find the influence of: Kramer's effect, a lifting surface passing through a vortex sheet, wake contraction, blade motion, wake adaption and blade proportions. (Author)

James Forrestal Research Center, Princeton, N. J.
BIBLIOGRAPHY OF UNCLASSIFIED SQUID PUBLICATIONS, Supplement B, 1 July 57-1 June 59, to Ten Years of Project SQUID -- a Bibliography, Contract Nonr-1858(25). Dec 59, 21p. 68 refs. Proj. Squid Technical rept. no. PR-67-P-B, Suppl. to Technical rept. nos. PR-67-P and PR-67-P-A; AD-236 164.
Order from LC mi$2.70, ph$4.80 PB 152 153

Contents:
Properties of materials (Transport, Structural)
  Gases, liquids, and solids
Physical processes
  Heat transfer
  Mass transfer and mixing
  Fluid flow
  Mathematical physics
Chemical processes
  Reaction kinetics
  Thermodynamics and thermochemistry
Combustion phenomena
  Ignition
  Flame propagation rate
  Laminar
  Turbulent
  Flame structure and stability
  Flame spectra and radiation
  Miscellaneous
Engines and propulsive systems
Instrumentation
  Temperature measurement
  Pressure measurement
  Miscellaneous
(See also PB 136 669)

James Forrestal Research Center, Princeton, N. J.
PROJECT SQUID. Semi-annual progress rept. for 1 Apr-30 Sep 59 on Contract Nonr-1858(25). 1 Oct 59, 105p. 50 refs. AD-228 128.
Order from LC mi$5.70, ph$16.80 PB 152 155

Contents:
Fluid mechanics
  Fundamental investigation of nonsteady flow
  Investigation of turbulence
  Structure of a detonation wave
  Investigations in magnetohydrodynamics
Transport and transfer processes
  Thermal conductivity and the viscosity of ammonia and hydrazine
  Thermal conductivity of gases and liquids over a range of temperatures and pressures
  Statistical properties of two-phase flow
Chemical kinetics
  Elementary reactions in combustion
  High temperature reactions
  Surface-catalyzed atom and free radical reactions
  Investigation of reaction kinetics in high-temperature gases
Combustion phenomena
  Structure and burning mechanism of laminar flames
  Research on high pressure combustion

Investigation of gaseous combustion and transport properties of gases at high temperature
Ionization in flames
Ionization in detonation waves
Total radiation from burning solid propellant strand
Rapid response temperature probe
Plasmaflow in nozzles
(See also PB 145 886)

Lockheed Aircraft Co., Sunnyvale, Calif.
GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959-JANUARY 1960. VOLUME I. PROPULSION CHEMISTRY AND PROPULSION PHYSICS. Jan 60, 193p. 114 refs. LMSD-228140.
Order from LC mi$8.70, ph$30.30 PB 150 613-1

Contents:
Part 1. Propulsion Physics
Thermionic theory and technique (LMSD-311695)
Ionic propulsion - an assessment (LMSD-48456)
A nuclear-ionic system for space flight
Optimum proportioning of two propellants to obtain maximum burnt velocity (Pub. in ARS Jnl. Aug 59)
A thermal-electronic convertor (LMSC-5106)
Metallic carbides as emitter materials in thermal-electronic convertors
Part 2. Propulsion chemistry
Phosphorus-fluorine oxidizers (LMSD-49771)
Investigation of nitro compounds as oxidants for high-energy chemical systems. I. Lithium dinitroethane (LMSD-48407). II. Methylenedinitramine (LMSD-48408)

Lockheed Aircraft Corp., Sunnyvale, Calif.
GENERAL RESEARCH IN MATERIALS AND PROPULSION, JANUARY 1959-JANUARY 1960. VOLUME II. METALLURGY AND CHEMISTRY. Jan 60, 275p. 63 refs. LMSD-288140.
Order from LC mi$11.10, ph$42.60 PB 150 613-2

Contents:
Electronic structure of beryllium (LMSD-288003)
Electrical resistivity of beryllium
Plastic deformation in beryllium
Beryllium analyzed for trace impurities by gamma-ray activation
High-temperature corrosion of beryllium in air
Stress corrosion cracking of beryllium (LMSD-49735)
Grain refinement in beryllium by alloying
Specific heats of beryllium and an alloy at room and elevated temperatures (LMSD-2702)
Studies of the gas carburization of niobium
Study of halide-containing oxide films on columbium
(See also PB 150 613-1)

Naval Weapons Lab., Dahlgren, Va.
DYNAMIC TESTING OF THE 0.7-ES-6400 (MK 29 MOD 0) ROCKET MOTOR, by D. W. Culbertson. 30 Aug 60, 22p. 2 refs. NWL Rept. 1715.
Order from LC mi$2.70, ph$4.80 PB 150 972

Results of eight track tests conducted to determine the dynamic performance of the 0.7-ES-6400 (Mk 29 Mod 0) Rocket Motor under service conditions of acceleration and temperature are presented. As a result of these tests it is concluded that the 0.7-ES-6400 (Mk 29 Mod 0) Rocket Motor will perform satisfactorily under service conditions of 15-18 g's acceleration at temperatures of -65°F to +145°F. The motor is considered capable of withstanding the transverse and lateral vibration loadings imposed during track firings. Basic motor properties of short burning time, medium thrust level, and a high ratio of propellant weight to total weight are desirable features of a propulsion system for use on short, medium speed tracks such as the NAVWPNLAB 520 ft. facility. (Author).

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
THE MAGNETIC INDUCTION PLASMA ENGINE, by Milton U. Clauser. 19 Aug 60, 40p. 14 refs. STL/TR-60-0000-00263.
Order from LC mi$3.00, ph$6.30 PB 150 882

A comparison of conventional electric motors and plasma propulsion engines shows that the categories of series, shunt, and induction motors are also of value when applied to the plasma engines. The only engine which allows the plasma to magnetically insulated from the walls, and thereby eliminates the unacceptably large heat transfer to the walls, is the magnetic induction plasma engine. In comparing the ion engine and the plasma engine, it is seen that the ion engine is seemingly simple in concept but is proving to be complex in its design; the plasma engine, on the other hand, is complex in theory, yet like the induction motor it holds the hope of being simple in design and operation. It further appears that while the ion engine may have difficulty in achieving 1 pound of thrust, this tends to be the lower limit for the plasma engine, which can be easily extended to larger thrusts. The use of different propellants in the MIP engine makes it possible to efficiently achieve different values of specific impulse. Deuterium is appropriate above 5000 seconds and will be used on those engines which are competitive with the ion engines. Lithium is appropriate in the 2500-3500 second range which is two low to be achieved by the ion engine and too high to be achieved by the arc jet. Design parameters are given for a deuterium engine and a lithium engine. The calculated weights and efficiencies are encouraging. (Author).

Rocketdyne [Canoga Park, Calif.]
EXPERIMENTAL ELECTRICAL PROPULSION, by C. R. Dulgeroff and G. D. Seele. Final rept. for 1 May 58-31 May 60 on Contract AF 49(638)351. July 60, 74p. 12 refs. R-2565; AFOSR-TR-60-112.
Order from LC mi$4.50, ph$12.30 PB 150 861

The investigation of ion thrust chamber geometry, using both an accelerate-decelerate electrode geometry and a modified Pierce two-electrode geometry design, showed the latter design to be superior inasmuch as it showed improved focusing properties, i.e., a decrease of beam interception by the acceleration electrode. The perveance of the latter system was experimentally determined to be 3.45×10^{-9} amp/volt$^{3/2}$. Current densities for plane ionizer surfaces up to about 12 ma/cm^2 for either tungsten, tantalum, or titanium carbide ionizers were measured by using a calorimetric collector. Thrust measurements of 40 to 50 micropounds were made by a pendulum-type collector. Other performance tests showed a sputtering rate of about

22 gm/amp hr for 9-kev cesium ions on nickel and an ionization efficiency of greater than 90 percent over a 30-hr period. Tungsten, molybdenum, nickel, and 321 stainless steel are generally compatible with cesium at 700 C but at 1000 C, intergranular attack of nickel and moderate to severe pitting of stainless steel by cesium occurs over reaction periods of 100 hr. (Author)

Sundstrand Turbo Div., Sundstrand Corp. [Pacoima, Calif.]
ANALYSIS AND MEASUREMENT OF CHEMICAL CONVERSION TIME IN A LIQUID FUEL ROCKET ENGINE WITH DISTRIBUTED COMBUSTION, by L. L. Bixson. Technical note no. 8 on Contract AF 18(603)107. 26 July 60, 23p. 2 refs. S/TD no. 1855; AFOSR-TN-60-886; AD-243 095.
Order from LC mi$2.70, ph$4.80 PB 150 835

A major goal of the rocket scaling program is to develop a valid method of measuring chemical conversion time (Tau). The need for such fundamental measurements is supported by the concept of chemi-acoustic coupling and its importance to high frequency combustion instability. Concise analytical models were previously developed which describe the combustion chamber pressure decay curves for both the cases of concentrated and distributed combustion. The models were based on the assumption of instantaneous propellant shut-off during steady-state combustion. In this note the previous analysis is extended for the case of distributed combustion to permit direct, reasonably accurate computation of Tau from experimentally obtained pressure decay histories. Data are presented which strongly support use of the distributed combustion model for the LOX, RP-1 propellant system which is presently under investigation. (Author)

Sundstrand Turbo Div., Sundstrand Machine Tool Co. [Pacoima, Calif.]
THE EXPERIMENTAL DETERMINATION OF CHEMICAL CONVERSION TIMES IN LIQUID FUEL ROCKET ENGINES, by J. W. Bjerklie. Technical note no. 5 on Contract AF 18(603)107. 15 Mar 58, 22p. 2 refs. S/TD no. 1232; AFOSR TN-58-415; AD-158 218.
Order from LC mi$2.70, ph$4.80 PB 148 264

The experimental determination of effective time delays in rocket engines according to Barrere: Two alternate methods of interpretation are described mathematically based on the assumptions of concentrated and distributed combustion. Analysis of pressure decay at the time of propellant shutoff and its relation to chemical conversion time, τ, in rocket thrust chamber: The case of distributed combustion is analyzed by starting with a law of burning sprays which has been shown to be in good agreement with experiments. The results for both analyses of distributed combustion are shown to be identical.

Technische Hochschule, Wien (Austria).
CONDUCT THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE MIXING OF COOLING AIR WITH COMBUSTION PRODUCTS IN A COMBUSTION CHAMBER, by Herbert Melan. Technical (final) rept. on Research on Combustion Chambers, Contract AF 61(052)93. 31 Oct 59, 36p. AFOSR-TR-59-197.
Order from LC mi$3.00, ph$6.30 PB 150 332

The purpose was to test a new type of a combustion chamber for gasturbines without a special flametube but having a swirl (vortex-) chamber at the inlet and at the exhaust of the combustion chamber. The tests with hot gases with the tests of cold and warm air show that with the new form of the combustion chamber a good bit of the hypotheses are fulfilled. It is possible to build a chamber without a flametube and by application of two specially formed swirl chambers at the inlet and at the exhaust, the wall temperatures can be diminished. At the exhaust it is possible to get a more or less similar distribution of the outlet temperatures. The efficiency is not satisfying.

Manufacturing Equipment and Processes

Brush Beryllium Co., Cleveland, Ohio.
FABRICATION OF BERYLLIUM WIRE, by A. G. Gross, Jr., R. G. O'Rourke and W. W. Beaver. Progress rept. no. 3, 16 Feb-16 Apr 59, on Contract NOas-59-6030-C. [1959] 48p. 7 refs. Technical rept. no. 150; AD-217 515.
Order from LC mi$3.30, ph$7.80 PB 152 197

This report released for sale to the public 28 Oct 60.

True-stress - true-strain tensile properties below 800°F were investigated. The results indicated reproducible ductile behavior as low as 750°F, allowing the use of lower working temperatures which should favor more efficient lubrication in the drawing die. Several fixturing improvements were made for use on the draw-bench. Drawing experiments to data have produced rod at 0.144-inch diameter (drawn from 0.252-inch diameter), a quantitative evaluation of molybdenum disulfide plus powdered graphite for lubrication, pointing techniques, and a cleaning technique. These experiments, further, have proved certain procedures unacceptable. Tensile testing of drawn stock substantiated the basic applicability of the Power Law of Strain Hardening. Metallographic and X-ray studies have shown the development of crystal arrangements quite similar to those found in extruded beryllium. Initial heat-treating experiments have provided an optimistic suggestion of control of mechanical properties through thermal treatment after drawing. (Author) (See also PB 149 617)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
STATISTICAL ANALYSIS OF TENSILE PROPERTIES OF HEAT-TREATED Ti-4Al-3Mo-1V SHEET, by H. R. Ogden, G. H. Beatty and A. E. Mace. Rept. on Contract AF 19(600)1375. 16 Sep 60, 45p. DMIC rept. 461.
Order from OTS $1.25 PB 151 095

Some of the data developed through Phase I of the Titanium-Alloy Sheet-Rolling Program have been analyzed statistically to determine the magnitude of the variation in the tensile properties and the relation between these properties and some of the processing variables. (Author)

Naval Engineering Experiment Station, Annapolis, Md.
A STUDY OF METALLIZING AND CHROME PLATING PROCEDURES FOR RECONDITIONING OF WORN CRANKSHAFTS, by W. Lee Williams. Progress rept. no. 2. 10 Jan 56, 26p. 4 refs. Research and Development rept. 040040F.
Order from LC mi$2.70, ph$4.80 PB 152 642

This report released for sale to the public 10 Nov 60.

The object is to determine the best procedures for reconditioning of worn crankshafts on the basis of minimum loss in fatigue resistance. The experiments in this report deal with: determining the optimum fillet form for undercut areas in the way of chrome plating; determining the relative effects of cut-wire peening and shot peening as procedures to induce residual compressive stresses in the way of plating; and determining whether fatigue resistance is lowered by tempering of induction hardened journal surfaces to a machinable level prior to reconditioning. (Author)

Transport, Traction and Hoist Facilities

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
STRESSES UNDER MOVING VEHICLES: TRACKED VEHICLES (M29C, D4 AND D7) ON FAT CLAY, 1956, by J. E. Green and D. R. Freitag. Rept. on Trafficability of Soils as Related to the Mobility of Military Vehicles. July 60, 50p. 3 refs. Technical rept. no. 3-545, rept. 3; AD-241 537.
Order from LC mi$3.30, ph$7.80 PB 152 073

The results of a test program conducted to measure stresses induced in fairly soft soils by moving tracked vehicles are presented. Three types of pressure-sensing devices were installed in prepared areas of fat clay, and these areas were trafficked by the M29C weasel and the D4 or D7 engineer tractor. Speed, load, and direction (forward or in reverse) of the moving vehicle were varied during the testing, and the stresses at various depths and offsets were measured by means of three types of pressure cells. It is believed that such factors as inadequate vehicle-alignment control and cell movement during the tests may have caused the measured stresses to vary considerably from pass to pass. It was found that stresses in the soil under a tracked vehicle are not uniformly distributed. It was concluded that stresses under a loaded track system decrease with depth and offset, but not as rapidly as indicated by elastic theory. It is recommended that the program to study the stress distribution beneath the traction and supporting elements of vehicles be continued and that the program be expanded to include: (a) studies of vehicles towing loads; (2) studies of the influence of soil properties on stress magnitudes and stress pattern; and (c) measurements of static stresses. (Author)

Land Locomotion Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
DETERMINATION OF k_c, k_ϕ, n-VALUES BY MEANS OF CIRCULAR FOOTINGS, MODIFIED PROCEDURE, by B. Hanamoto and Z. Janosi. Nov 59, 15p. 4 refs. Rept. no. 57.
Order from LC mi$2.40, ph$3.30 PB 150 999

It has been shown by means of theoretical and experimental methods that the size effect of a circular footing penetrating vertically into soil has to be considered by applying to equation $p = (\frac{k_c}{b} + k_\phi)z^n$ the radius of the plate instead of the diameter. Slight discrepancies formerly noted between soil values established by means of rectangular and circular plates can be thus eliminated. (Author)

Michigan U., Ann Arbor.
OPERATIONAL DEFINITION OF MECHANICAL MOBILITY. SUPPLEMENT [NO. 1] by Thomas A. Davis. Rept. on Contract DA 20-018-ORD-14620. Nov 59, 49p. 2 refs. OTAC rept. no. [LL] 55.
Order from LC mi$3.30, ph$7.80 PB 150 998

Transportation of a payload made up of a number of different types of commodities can be optimized in off-the-road locomotion when using physical soil-vehicle relationship defined in terms of speed time, and fuel consumption. This had been demonstrated by the optimization of types of motor vehicles and their numbers selected from the available pool. Terrain conditions and distances to be traveled have been included in overall consideration. Linear programming methods have been applied when terrain was "passable". Other methods were discussed in the case of impassable obstacles. (Author)

Stanford U. Graduate School of Business, Calif.
AN IMPROVED TRANSPORTATION MOVEMENT SYSTEM OVERSEAS, by H. J. Canty, J. O. Carter and others. Final Rept. on Phase 2, Contract DA 44-177-TC-496. July 60, 244p.
Order from LC mi$11.10, ph$37.80 PB 150 612

This report presents a proposed improved system for transportation movements of personnel and cargo in an overseas area, highway traffic regulation and control, and budgeting and accounting for transportation movements. One portion of the report describes a complete manual system, while a subsequent section deals with the application of Automatic Data Processing (ADP) to such a system. Annexes to the report include a comprehensive glossary of terms, requirements of the contract, a description of the Study Task Group, and other supplementary material. (Author). (See also PB 150 611).

Stanford U. Graduate School of Business, Calif.
THE TRANSPORTATION MOVEMENT SYSTEM IN USAREUR-1958. Final rept. on Phase 1, Contract DA 44-177-TC-496. [1958] 257p.
Order from LC mi$11.10, ph$39.60 PB 150 611

This report summarizes the Army Transportation Movements (T-Movements) system in effect in the European Theater during the fourth quarter of 1958. It consists of the material gathered and produced during a detailed study of the system in effect in those countries of Europe in which US Forces are stationed. The report includes a definition of the system and study, and a summary of the present system.

MATERIALS

Air Force Cambridge Research Center, Bedford, Mass.
MEASUREMENT TECHNIQUE FOR NARROW LINE-WIDTH FERROMAGNETS, by J. I. Masters, B. R. Capone, and P. D. Gianino. May 60, 10p. 4 refs. AFCRC-TN-60-388.
Order from LC mi$1.80, ph$1.80 PB 150 412

Measurement of the line width of a ferromagnetic resonance curve using the cavity perturbation method offers some difficulty in the case of fractional oersted line widths. A new technique is described which utilizes reradiation of the incident power by the magnetic sample into an induction loop in the waveguide system. Data are given showing how line widths measured by both methods compare. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
ADHESIVE BONDING OF METALS FOR ADVANCED ORDNANCE APPLICATIONS, by John J. Veliky, Raymond F. Wegman and others. Sep 60, 21p. 2 refs. Technical rept. FRL-TR-8
Order from OTS $0.75 PB 161 863

This investigation was conducted to determine the practicability of bonding to various unusual metals such as beryllium, chromium, gold, silver, and uranium 238. Two commonly used thermosetting adhesives, a polyester and a poly-sulfide-modified epoxy, were selected for evaluation on the basis of their ability to adhere to a variety of surfaces and their good cohesive strength characteristics. A modified epoxylated novolac was also evaluated for bonding some of the metals. Two additional adhesives, a polyurethane and an epoxy polyamide, were selected for use with the uranium because of difficulties encountered in bonding to this metal. (Author)

Marine Lab., U. of Miami, Coral Gables, Fla.
MARINE BORER INVESTIGATIONS. Final rept. on Contract NOy-81879. May 60, 33p. 5 refs. Rept. 60-1; ML 60106.
Order from LC mi$3.00, ph$6.30 PB 150 954

The Marine Laboratory's marine borer control program constitutes an effort to combine knowledge of the biology of marine wood boring organisms, the chemistry of wood and wood preservatives, and the properties of sea water, in an attempt to improve the performance of conventional wood preservatives by modification, or to develop new preservatives having improved performance. (See also PB 140 841)

Snell, Foster D., Inc., New York.
NAVAL AIRCRAFT DE-ICER AND ANTI-ICER, by W. Rosenblatt, E. L. Jung, and J. Mitchell Fain. Final rept. on Contract NOas 54-167-c. 30 July 54, 56p. AD-46 281.
Order from LC mi$3.60, ph$9.30 PB 150 876

This report released for sale to the public 31 Oct 60.

The development is described of a de-icing and anti-icing material for use on naval aircraft. A new compound, 2911F-94, which is recommended for use, contains ethylene glycol and potassium acetate with suitable corrosion inhibitors, a thickening agent, and a wetting agent. In addition to good ice-melting and-inhibiting properties, the components of 2911F-94 are available and relatively inexpensive. The previously recommended compound 2911B-820I was redesignated 2911F-820 and revised to meet the requirement of not freezing solid at -65°F; the proportion of LiCl was reduced to 37%. An investigation was made of the effect of the de-icing fluid B-820I on the lubricating greases intended for general use on aircraft; results showed that B-820I has no more deleterious effect than water alone. The use of LiCl in the de-icing solution is more efficient if the LiCl is applied as a concentrated solution than if the same amount is applied in a more dilute solution. The efficiency of ethyleneglycol-potassium acetate formulations as de-icers was evaluated. Studies of the effect of waxed wing surfaces on the application and effectiveness of various de-icing compounds indicated that the wetting agents performed satisfactorily; no contraction of the compounds was noticed for 24 hr.

Structural Mechanics Research Lab., U. of Texas, Austin.
HIGH-VELOCITY IMPACT CUSHIONING. PART V. ENERGY-ABSORPTION CHARACTERISTICS OF PAPER HONEYCOMB, by Charles H. Karnes, James W. Turnbow and others. Rept. on Contract DA 19-129-qm-817. 25 May 59, 119p. 11 refs. AD-225 216.
Order from LC mi$6.00, ph$18.30 PB 150 631

A review is presented of the energy-absorption characteristics of paper honeycomb. For a given set of test conditions, a unique stress-strain curve for a particular grade of honeycomb exists and is that curve obtained when the cushion is completely crushed. The average crushing stress for any paper honeycomb cushion may vary ± 10% from the mean value for that grade of material. The stress and energy-absorption values are about 44% larger under dynamic loading than for static loading, while the strain values at bottoming are nearly equal. Except for an initial peak, stress levels are about constant up to 70% strain under both dynamic and static conditions; a rapid increase in stress occurs about 80% strain. For practical cushion design no appreciable difference in stress-strain characteristics occurs for impact velocities from 20 to 90 fps. Moisture contents of less than 10 to 12% have little effect on the dynamic cushioning characteristics of paper honeycomb. Increases in moisture content cause the denser materials to lose energy-absorbing capacity more rapidly than the lighter honeycombs. The effect of moisture is less significant in dynamic loading than in static loading. The dynamic stress and energy-absorption values of honeycomb material increase rapidly with increase in density. The resilience of paper honeycomb is nearly constant until the strain exceeds 70%, and is higher for the more dense materials.

Ceramics and Refractories

Armour Research Foundation, Chicago, Ill.
ULTRASONIC AND CERAMIC COATINGS, by R. R. Whymark and W. E. Lawrie. Rept. for 1 Apr 59-29 Feb 60 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)6396. May 60, 52p. 1 ref. WADD Technical rept. 60-157.
Order from OTS $1.50 PB 171 057

This report describes investigations into the use of ultrasonic techniques to determine strength of ceramic-metal bonds and to locate defects in the bonds. The techniques evaluated have involved the use of both high frequencies (1-10 mc/s), low frequencies (14 kc/s) and the simultaneous use of high and low frequencies. Experiments at low signal frequencies indicate the average bond strength of flame-sprayed zirconium oxide to be about 1500 psi. Promising results have been obtained using high frequency transmitted energy and a Schlieren detection system. Apparatus is designed to generate surface acoustic waves. The application of surface waves to defect detection is considered. An experimental method has been developed to utilize intermodulation between high and low frequency sound waves to indicate bond continuity. Intermodulation techniques obviate the need for repeatable coupling of transducers which is required in direct high frequency transmission methods. Consideration is given to ultrasonic image converter systems. (Author)

Army Signal [Research and Development] Lab. Fort Monmouth, N. J.
STUDY OF AGING EFFECTS ON DIELECTRIC ELECTROMECHANICAL PROPERTIES OF FERROELECTRIC CERAMICS, by N. A. Terhune and J. J. Charlton. [1956] 7p.
Order from LC mi$1.80, ph$1.80 PB 152 805

This report released for sale to the public 18 Nov 60.

Brush Beryllium Co., Cleveland, Ohio.
AN INVESTIGATION OF INTERMETALLIC COMPOUNDS FOR VERY HIGH TEMPERATURE APPLICATIONS, by Robert M. Paine, A. James Stonehouse, and Wallace W. Beaver. Rept. for 13 Mar 57-31 Oct 58 on AEC-ANP Materials Research, Contracts AF 33(616)56-12 and AT(30-1)541. July 60, 130p. 9 refs. WADC Technical rept. 59-29, Part II; unclassified version of WADC TR 57-240, Part II.
Order from OTS $3.00 PB 171 081

The preparation, fabrication, and properties of intermetallic compounds under development for service in the temperature range of 2300° to 3000°F are described. The compounds have exhibited strength as measured by the modulus-or-rupture test of up to 40,000 psi at 2700°F and resistance to oxidation for 100 hours to 2800°F and have indicated good thermal conductivity. The compounds were prepared by solid-state reactions and fabricated chiefly by hot-pressing techniques. Oxidation tests were made in dry air to 3000°F and in moist air to 2500°F. Transverse-rupture tests were carried out at 2300°, 2500°, and 2750°F. Room-temperature hardness data and melting points are reported for some compounds. Thermal-expansion and thermal-conductivity data for selected compounds are also presented. (Author)

Carborundum Co., Niagara Falls, N. Y.
CONTINUOUS FILAMENT CERAMIC FIBERS, by W. A. Lambertson, D. B. Aiken and E. H. Girard. Rept. for Jan 59-Feb 60 on Air Force Textile Materials, Contract AF 33(616)6246. June 60, 84p. 45 refs. WADD Technical rept. 60-244.
Order from OTS $2.25 PB 171 061

Melting and fining of refractory glass compositions and drawing of continuous filament ceramic fibers have been carried out in a dry, inert-atmosphere glovebox, which permitted the use of refractory metals, graphite, and boron nitride as crucible and heater materials, and prevented the adsorption of moisture by the filaments. Several refractory glasses in the baria-alumina-silica, calcia-alumina-silica, and magnesia-alumina-silica systems were successfully drawn into continuous filamets. Tensile strengths of filaments drawn were determined at room and elevated temperatures. Values as high as 138,000 pounds per square inch at room temperature and 132,000 pounds per square inch at 1500°F. (815°C.) were obtained. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
PROPERTIES OF REFRACTORY MATERIALS: COLLECTED DATA AND REFERENCES, by Wanda G. Bradshaw and Clayton O. Matthews. 2nd ed. 3rd printing, 15 June 60, 114p. 114 refs. LMSD-2466.
Order from OTS $2.50 PB 171 101

A survey of the elevated-temperature characteristics of refractory materials melting above 2500°F was made. Data have been tabulated for evaluation of these materials for use in elevated-temperature nuclear reactors, and in high-temperature missile applications. Data on the melting points, ductility, and elevated-temperature stability of the refractory metals, carbides, nitrides, oxides, silicides, sulfides, beryllides, aluminides, other intermetallics, phosphates, and uranates are presented. The thermal shock resistances, thermal conductivities, thermal expansions, and emissivities reported for these materials are given. The effect of nuclear radiation on ceramics is reported. The mechanical properties of refractory materials are briefly reviewed. Sources of thermodynamic data for these materials are presented. The effects of various gas coolants, helium and its major likely contaminants, oxygen and water vapor, hydrogen, nitrogen, and other gases on refractory materials are also reported. Where conflicting or variable data exist, the original authors are cited. (Author)

Olin Mathieson Chemical Corp., New Haven, Conn.
INVESTIGATION OF GLASS FLAKE LAMINATES, by J. J. Aclin and T. A. Cocca. Final rept. on Contract DA 19-020-ORD-4751. 2 Feb 60, 52p. 8 refs. AD-233 969.
Order from OTS $1.50 PB 171 039

Three methods of preparing glass lamellates have been developed. Each method appears to be commerically

feasible. The techniques differ in the method of combining the resin and glass flakes and may be summarized as follows: (1) spraying free falling glass flakes with resin in a plenum chamber and "B" staging prior to molding; (2) coating the glass flakes with resin by mixing in a centrifuge; and (3) dry blending of powdered "B" stage resin and glass flakes. The lamellates produced by these processes have excellent physical properties, except for impact and tensile strength which are somewhat low. The low values may be due to the excessive quantity of fine particles of glass in commercial glass flakes. Two practical applications for glass flake laminates have been suggested by this work: (1) rocket exhaust nozzles and (2) rocket cases. (Author)

Utah U., Salt Lake City.
SURFACE AND ENVIRONMENTAL EFFECTS ON CERAMIC MATERIALS, by P. Gibbs, G. S. Baker and others. Rept. for June 58-May 60 on Ceramic and Cermet Materials, Contract AF 33(616)5876. Aug 60, 29p. 11 refs. WADD Technical rept. 60-473.
Order from OTS $0.75 PB 171 074

Creep and recovery phenomena in sintered polycrystalline alumina have been studied. Effects of temperature and impurity content on creep behavior and the results of observation of polished and etched surfaces are discussed. The results are analyzed in terms of a tentative conventional mechanical analog. An electrical study of the behavior of silver ions on a corundum surface is described. Current flow between evaporated silver films on Al_2O_3 crystals is investigated as a function of geometry, temperature, atmosphere, history, and applied voltage. The initial stages of creep in single crystals of αAl_2O_3 (synthetic sapphire) have been investigated as a function of stress and temperature. Creep rates were measured in the temperature range 1000°C to 1200°C and in the stress interval of 500 to 1000 Kg per $cm.^2$ resolved shear stress on the outermost fiber of the specimen. The stresses covered the region from too little stress to initiate creep up to the fracture stress. A plot of log. creep rate versus reciprocal temperature gives an activation energy of 85 Kcal/mole. Specimens oriented so that $(11\bar{2}0)$ $(1\bar{1}00)$ slip system was operative but the (0001) $(11\bar{2}0)$ slip system had zero resolved shear stress gave no significant creep at these temperatures. (Author).

Fuels, Lubricants, and Hydraulic Fluids

Air Force Flight Test Center, Edwards AFB, Calif.
DECONTAMINATION OF LARGE LIQUID FLUORINE SPILLS, by Ronald P. Rickey. Oct 59, 31p. AFFTC-TR-59-31; AD-228 033.
Order from LC mi$3.00, ph$6.30 PB 152 297

The main objective of the tests was the development of an effective neutralization of liquid fluorine spills. The minimum requirement would be the reduction of fluorine-concentration on the ground at the edge of the reservation at Highway 395 (6 miles downwind) to a level below one part per million. Preliminary test at General Chemical's plant at Baton Rouge indicated that water spray and/or sodium carbonate (soda ash) would be effective materials for testing. Using these as the neutralizers, a total of 5000 pounds of fluorine was spilled at the Haystack Butte area. A third spill was not neutralized and was used for comparison with the two methods. The water spray was the most effective; the carbonate neutralization was moderately effective. The unneutralized fluorine was detectable 6 miles downwind from the spill. A combination of water fog and/or sodium carbonate should give acceptable neutralization of liquid fluorine in the case of a large spill. (Author).

Army Ordnance Corps, Washington, D. C.
SAFETY REQUIREMENTS FOR THE MANUFACTURE AND LOADING OF CASTABLE COMPOSITE PROPELLANTS. 1 Mar 60, 13p. ORDM 7-230.
Order from LC mi$2.40, ph$3.30 PB 152 354

This report released for sale to the public 25 Oct 60.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
COMPATIBILITY OF ROCKET PROPELLANTS WITH MATERIALS OF CONSTRUCTION, by W. K. Boyd and E. L. White. Rept. on [Contract AF 18(600)1375]. 15 Sep 60, 65p. 200 refs. DMIC memo. 65.
Order from OTS $0.50 PB 161 215

This report summarizes the available information on the compatibility of liquid rocket propellants with prominent materials of construction. It is pointed out that compatibility data for materials not ordinarily covered by the Defense Metals Information Center are included. These data were found during the search for information on materials that are within the scope of the DMIC, and are included for convenience. Fuels and oxidizers of current interest are discussed. The corrosion data which are presented will apply to storing, handling, and control equipment outside of missiles and to missile components up to the combustion chamber. The compatibility of materials with reaction products in combustion chambers, nozzles, etc., has not been considered.

[Feltman Research] Labs., Picatinny Arsenal, Dover, N. J.
ANALOG COMPUTER COMPUTATION OF PROPELLANT LINEAR BURNING RATE, by Arthur I. Rubin. Mar 56, 33p. 3 refs. Technical rept. 2237.
Order from LC mi$3.00, ph$6.30 PB 152 351

This report released for sale to the public 28 Oct 60.

Unique circuitry was developed to compute linear burning rate from closed bomb data with the Ease analog computer. Results of this computation are permanently recorded as a continuous curve representing linear burning rate as a function of pressure. Significant savings in computing time are achieved by the analog computer. The desk-calculator method computes only five or six points on the burning rate pressure graph. To illustrate the method, details of the analog computer computation are shown for a representative problem. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
DEFLAGRATION LIMITS IN THE STEADY LINEAR BURNING OF A MONOPROPELLANT WITH APPLICATION TO AMMONIUM PERCHLORATE, by W. E. Johnson and W. Nachbar. Technical note on Contract AF 49(638)412. Aug 60, 42p. 17 refs. LMSD-703060; AFOSR-TN-60-700; AD-243 489.
Order from LC mi$3.30, ph$7.80 PB 152 027

An analytical model for the steady, linear burning of a monopropellant is employed to describe the results of experiments done elsewhere on the burning of pressed, pure ammonium perchlorate pellets. Upper and lower bounds for the eigenvalue of the mathematical problem are derived. These bounds are convenient to use for numerical computations, and they afford a rigorous estimate of the approximation error. In following the hypothesis that the low-pressure deflagration limit (p_{DL}) observed in these experiments is due to radiant energy loss from the burning surface of the pellet, it is first demonstrated analytically that the model will also display a similar p_{DL} upon introduction of a term representing this loss. It is shown that, with reasonable numerical values, a good fit can be obtained from this theory to the experimental burning rate vs. pressure curve for pressures well above p_{DL}. However, the calculated value of p_{DL} due to surface radiant loss is much less than the observed value, and agreement with experiments is obtained only when an energy loss greater than that which can be presently accounted for is assumed. (Author)

Naval Ordnance Test Station, China Lake, Calif.
SCREW EXTRUSION OF SOLVENTLESS DOUBLE-BASE PROPELLANT IN ECCENTRIC SHAPES, by James R. Sims. 1 Mar 60, 31p. NOTS TP 2041; NAVORD rept. 5894.
Order from LC mi$3.00, ph$6.30 PB 150 390

Development work was performed on the extrusion of eccentric shapes of solventless double-base propellant for possible inclusion in a segmented grain. The 1-inch screw extruder was used as a processing tool. Equipment design and test extrusions for each of three segment designs are described and the results are discussed. The propellant flow and expansion characteristics are shown to be significantly different in concentric and eccentric extrusions. Methods of compensation for these differences were investigated. The feasibility of extruding eccentric shapes with a screw extruder was demonstrated. (Author).

Naval Research Lab., Washington, D. C.
MICROBIAL INHIBITORS FOR SYSTEMS OF JET FUEL AND WATER, by Dorothea E. Klemme and John M. Leonard. Interim rept. 31 Aug 60, 11p. 9 refs. NRL rept. 5501.
Order from LC mi$2.40, ph$3.30 PB 146 402

Certain bacteria and fungi developing in water phases in conjunction with jet fuels are indicated as sources of trouble in these hydrocarbon materials. Growth of the microorganisms apparently decreases filterability of the fuel and otherwise causes malfunctioning of fuel systems. The biological tissue can clog filters. One possibility for controlling such microbial contaminations in fuel-water systems is the addition of a toxic agent that would prevent the development of the organisms. With this purpose in mind, twenty substances known to be toxic to microorganisms have been studied for inhibition in an environment of JP-5 fuel and aqueous salts solution, the fuel serving as the sole source of carbon. Four n-alkyl quaternary ammonium chlorides and an n-alkyl isoquinolinium chloride prevented bacterial growth when incorporated in the solution at 50 or 100 ppm, but not at lower concentrations. Only the isoquinolinium substance caused no turbidity in either the fuel or the water phase. Silver metal, toxic at exceedingly low concentrations, proved to be bactericidal in smaller amounts than required for fungicidal action. Tetraethyllead and ethylene dibromide, when incorporated individually in JP-5 at roughly 0.13 and 0.5 ml per gallon, respectively, were inhibitory to bacteria. In combination in the tetraethyllead antiknock preparation, however, these compounds exhibited a lesser degree of toxicity. Although none of the quaternaries were inhibitory at concentrations as low as desired, some of them may be useful in keeping microbial contaminations to a minimum in such trouble areas as storage tanks. But addition of inhibitors to jet fuels poses many complications, and for this reason, other approaches to the solution of the problems are under investigation. (Author)

Naval Research Lab., Washington, D. C.
A STUDY BY LIGHT SCATTERING OF THE EFFECT OF HIGH TEMPERATURE ON THE FORMATION OF INSOLUBLES IN JET FUELS, by R. L. Shuler, J. A. Krynitsky, and H. W. Carhart. Interim rept. 4 Oct 60, 19p. 21 refs. NRL rept. 5553.
Order from OTS $0.50 PB 161 921

An investigation of the chemical behavior of JP-4 and JP-5 fuels and pure hydrocarbon solutions heated to high temperatures (300° to 700°F) has been undertaken using light scattering and gas chromatography as the primary research tools. The extent of degradation of the hydrocarbon systems in this temperature range was evaluated on the basis of particulate matter formed. This quantity was estimated by the intensity of the light scattered at 45 degrees measured in a backward direction from the incident light. The experimental evidence obtained in this manner has clearly indicated that, in the temperature range studied, the oxidation of small amounts of nonhydrocarbon substances present in the fuel, e.g., sulfur and nitrogen compounds, gives rise to insoluble materials. The possibility of pyrolysis as a major decomposition process has apparently been eliminated by (a) the absence of particle formation in a fuel heated in an oxygen-free atmosphere and (b) an infrared spectral analysis which shows no gross changes in hydrocarbon structure after heating the fuel. The possibility of using the light-scattering technique to gain an insight into particle size by measuring the dissymmetry of scattering was explored.

Nonmetallic Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
LOAD SUPPORT AND ANTI-SCUFFING PROPERTIES OF LUBRICANTS. PART II. WADC UNIVERSAL GEAR AND SPLINE LUBRICANT TESTER, by Leslie R. Drane, Jr. Rept. for Jan 59-Jan 60 on Aviation Lubricants. May 60, 21p. 15 refs. WADC Technical rept. 59-736, Part 2.
Order from OTS $0.75 PB 171 055

The design and operating characteristics of a gear and spline lubricant tester are described. Results of studies to determine the effect of lubricant flow rate, gear speed, and inert atmosphere on gear scuff load are presented. Lubricant load carrying ability decreased sharply in the 5000 to 10,000 rpm range, but leveled off in the 15,000 to 20,000 rpm range. A slight increase in scuff load with increasing speed was noted in some cases. The use of an inert atmosphere caused a decrease in scuff load rating with a mineral oil, a sebacate, and a silicon-ester blend. Two silicone fluids showed no significant change in scuff load when tested in an inert atmosphere. (Author)

Nonmetallic Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
PERFORMANCE OF PETROLEUM BASED HYDRAULIC FLUIDS IN A PUMP LOOP AT 3000 PSI AND 275°F, by Robert E. Johnson. Rept. for Jan 56-July 59 on Power Transmission Technology. June 60, 87p. WADD Technical rept. 60-352.
Order from OTS $2.25 PB 171 063

Fluid breakdown and pump wear were investigated in a pump loop at 275°F and 3000 psi on five petroleum based hydraulic fluids. The mechanical shearing of these fluids resulted in excessive loss of viscosity, although their resistance to oxidation was not appreciably changed. The wide variations in the wear data of these fluids indicated their difference in lubrication characteristics in the particular system employed. Bench wear data did not correlate with the pump wear results. (Author)

[Office of Defense Research and Engineering] Washington, D. C.
SYMPOSIUM ON ANALYSIS OF NITRIC ACIDS SPONSORED BY THE PANEL ON FUELS REQUIRING OXIDIZERS. 31 Dec 51, 87p. 20 refs. Committee on Fuels and Lubricants rept. FRO 200/10.
Order from OTS $2.25 PB 171 115

Contents:
Wet methods of analysis
- Determination of nitric acid in metal contaminated solutions
- Analysis of fuming nitric acids
- Wet methods of analysis of nitric acids and mixed acids
- Volumetric analysis of white and red fuming nitric acid
- The determination of nitric acid by reduction with ferrous sulfate
- Methods of analysis for fuming nitric acids

Instruments, methods of analysis, and direct determination of water
- Determination of water in fuming nitric acid by infrared absorption
- The determination of water in white fuming nitric acid with a few comments on instrument methods for other components
- A field assay for white fuming nitric acid

Parker Aircraft Co., Los Angeles, Calif.
HYDROGEN HANDBOOK. A COMPILATION OF PROPERTIES, HANDLING AND TESTING PROCEDURES, COMPATIBILITY WITH MATERIALS AND BEHAVIOR AT LOW TEMPERATURES. Arthur D. Little, Inc., rept. on Contract AF 33(616)6710. Apr 60, 257p. 157 refs. AFFTC TR-60-19.
Order from LC mi$11.10, ph$39.60 PB 150 282

This report released for sale to the public 14 Nov 60.

This report summarizes (1) experience with and available technical information on the development of two prototype valves, one for a cryogenic gas service and the other for a cryogenic liquid service; (2) bibliographical information on the physical and mechanical properties of specific construction materials for a temperature range of -420°F to +200°F (these materials include some austenitic stainless steels and Teflon plastics); (3) the thermodynamic properties of helium, hydrogen, and nitrogen fluids with which the valves may be used or tested; (4) the hazards associated with the transportation and storage of hydrogen and with its use for testing the prototype valves for leakage across the seats; and (5) the sources and availability of hydrogen, and the Los Angeles regulations that apply to its transportation and use. (Author)

Shell Development Co., Emeryville, Calif.
FUNDAMENTALS OF GEAR LUBRICATION, by V. N. Borsoff. Final rept. for June 54-June 55 on Contract [NOas] 53-356-c. [1955] 128p. 11 refs. Rept. no. S-13649. AD-87 968.
Order from LC mi$6.30, ep$21.30 PB 152 755

This report released for sale to the public 15 Nov 60.

Research was conducted to explain the mechanism of gear lubrication and to determine the effects of gear geometry, operational, and lubricant factors. The investigation showed that unreactive minerals and synthetic oils operate in gears through the formation of a thick lubricating film. Such films deform viscously in slow-speed operations, but at high speeds, the oils behave as semi-elastic solids. With unreactive oils, breakage of the thick film results in scoring. Extreme pressure (EP) compounded oils operate by the formation of strongly attached films which are the product of the reaction between the metal and the active agent. Wear of gears was subdivided into: (1) wear by scoring; (2) wear by abrasion; and (3) wear by chemical corrosion before reaching the score load. The importance of viscosity as a lubricant factor was demonstrated with various synthetic oils. Changes in the viscosity effect with speed suggested the involvement of relaxation phenomena. The results of long-term wear tests agreed with those of the short-term tests. The long-term wear tests revealed that in operations at loads above the score load of the lubricant, the conditions are unstable and any shock or vibration may cause the recurrence of severe scoring. Gear geometry factors appreciably affected the load-carrying capacity. Tests with radioactive EP lubricants confirmed the theory of the action of EP agents through the formation of strongly attached EP films. The thickness of the EP films increased with temperature; for each set of operating conditions, an appropriate steady-state thickness of EP film is established. (See also PB 137 817)

Leather and Textiles

Quartermaster Research and Engineering Center, Natick, Mass.
DEVELOPMENT OF SHADE STANDARDS AND TOLERANCES FOR USAF BLUE 84 AND BLUE 584 SERVICE AND OPTIONAL WEAR UNIFORMS, by Frank J. Rizzo, Constantine J. Megas and others. Rept. for 26 Jan 53-1 Oct 58 on Air Force Textile Materials, Contracts AF 33(616)(53-221, 54-2, 55-72, and 54-107). May 60, 247p. 55 refs. WADD Technical rept. 60-150.
Order from OTS $3.50 PB 171 089

An extensive study of dye formulations was accomplished from which new highly colorfast formulations were developed. These formulations have application characteristics suitable for both large and small industry. The formulation selected represents somewhat of a compromise between colorfastness properties, application characteristics, availability factors and end use requirements. The complete program was monitored by application of both standard visual techniques and colorimetric analysis based on spectrophotometric data transposed in accordance with the tristimulus functions of the CIE standard observer for colorimetry. The tolerance ranges are visually well spaced, although the colorimetric spacing of the instrumental technique does not coincide with visual judgment. The reasons for this situation are analyzed, and it is concluded that a further review of the theory of color mixtures must be made for this type of blending operation. (Author)

Quartermaster Research and Engineering Center [Natick, Mass.]
DEVELOPMENT OF SHADE STANDARDS AND TOLERANCES FOR USAF TAN 505, by Frank J. Rizzo, Constantine J. Megas and others. Rept. for Jan 53-Jan 57 on Air Force Textile Materials, Contracts AF 33(616)53-221 and AF 33(616)55-72. May 60, 63p. 49 refs. WADD Technical rept. 60-294.
Order from OTS $1.75 PB 171 062

Shade standards and tolerances for USAF Tan 505 used in hot weather clothing have been developed in three fabric constructions using a formulation which has had considerable industrial application for a number of related shades. This program was monitored by visual as well as colorimetric procedures. The tolerance spacing visually should provide for a reasonable approach to a monotone appearance in uniforms made from two different pieces of fabric in the same construction. The shade characteristics of the three fabrics are such as to provide for use of any of the fabrics in a single ensemble. Whatever differences occur are more related to fabric texture than to specific differences in color. The colorimetric spacing obtained instrumentally does not coincide with the visual evaluation. The report discusses the reasons for this in detail. The degree of colorfastness achieved is optimum for the depth of shade. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
WOOL-TYPE 16-OUNCE SHIRTING FABRICS BLENDED WITH THREE FIBERS, by Constanti J. Monego and Lyman Fourt (Harris Research Labs.). Rept. no. 29 (Final) for 18 Sep 58 on Contract DA 19-129-qm-1073. May 60, 44p. 11 refs. Textile Series rept. no. 112.
Order from LC mi$3.30, ph$7.80 PB 150 548

Studies of the effects of fiber, yarn, weaving, and fulling variations have led to principles of design and finishing for promoting thickness and wool-type characteristics. Man-made fibers should be matched in diameter, length, and crimp with the wool; yarn twist should be relatively low; direction of twist should be opposite in warp and filling; float length should be relatively long; and fulling should be extensive, with up to 25 percent shrinkage in both width and length. Thickness should be developed by fulling alone, without napping, to conserve strength and obtain a wool-plated surface. Fabric thickness in the range of the standard shirting can be obtained without napping, using 35 percent non-wool fiber made up by 15 to 20 percent of pairs selected from acrylic, modacrylic, viscose rayon, cotton, or nylon fiber. The results indicate that nylon is advantageous for strength, and viscose rayon for strength, economy, fulling, and some aspects of resistance to flame and heat. Trials of differential shrinkage as an alternate or supplement to fulling indicate that much more development work will be required before this principle can be applied in this type of heavy woven fabric.

National Research Council, Washington, D. C.
FABRICS FOR COATING: MILITARY APPLICATIONS: PROCEEDINGS OF A CONFERENCE AT THE QUARTERMASTER RESEARCH AND ENGINEERING CENTER, NATICK, MASSACHUSETTS, OCTOBER 16-17, 1958, by Frank R. Fisher and Stanley Backer. 1959, 227p. 22 refs.
Order from LC mi$9.90, ph$34.80 PB 150 962

This report released for sale to the public 17 Nov 60.

Contents:
Army applications of fabrics for coating
Naval applications for coated fabrics
The role of coated fabrics in today's air force
Design for climatic extremes
Interactions of fabrics and coatings
Fabrics for coating—design and construction
New fibers and fabrics for coating
Technical advances in coating materials for fabrics
Technical problems of the coater
Evaluation of end item performance
Supplementary presentations
- Characteristics of vinyl and nitrile coating materials as well as a look at some newer products
- Butyl rubber in proofed goods applications
- The laminate structure
- Comments on fibers

Wyandotte Chemicals Corp., Mich.
DEVELOPMENT OF A FABRIC TO PROVIDE PERSONAL PROTECTION FROM TOXIC MATERIALS, by Raymond G. Spain and Alexander V. Sanger. Rept. for 1 May 59-30 Apr 60 on Air Force Textile Materials, Contract AF 33(616)6501. June 60, 45p. WADD Technical rept. 60-198.
Order from OTS $1.25 PB 171 058

This report describes research directed to the development of a coated fabric to resist the chemical effects of and be impermeable to high energy fuels (HEF). This program included the design and fabrication of special test equipment and of a laboratory fabric coating apparatus. A base fabric (Dacron) was selected on the basis of resistance to HEF, and the majority of the effort was directed toward the coating of this fabric with fluoroelastomer based compositions and the necessary subsequent testing. (Author)

Paints and Finishes

Marine Lab., U. of Miami [Coral Gables] Fla.
ANTIFOULING PROPERTIES OF PESTICIDAL MATERIALS, by Sigmund Miller. Monthly progress rept. for 1 May-15 June 59, on Contract NOa(s) 59-6182-c. 15 June 59, 7p. ML 59137.
Order from LC mi$1.80, ph$1.80 PB 150 768

The purpose of this program is to evaluate the effectiveness of various experimental and proprietary pesticides as antifouling toxicants. The screening test techniques which is employed will qualitatively classify the effectiveness of the pesticides for control of the various forms of fouling organisms. The first rack of 19 panels was exposed on 19 May 1959. When the panels were inspected after 10 days, fouling organisms were present on the control panel and on 15 test panels. Three panels were completely free of fouling. This group has not yet completed a full thirty day test period. Six additional racks of 19 panels each have since been exposed.

Marine Lab., U. of Miami [Coral Gables] Fla.
ANTIFOULING PROPERTIES OF PESTICIDAL MATERIALS, by Sigmund Miller. Monthly progress rept. for 1-31 July 59, on Contract NOa(s) 59-6182-c. July 59, 8p. ML 59182.
Order from LC mi$1.80, ph$1.80 PB 150 770

The effectiveness of the chemicals in preventing attachment of the various fouling organisms is listed in descending order of effectiveness. 84 of the 144 chemicals tested were completely ineffective, and have not been included in the table. (See also PB 150 769)

Marine Lab., U. of Miami [Coral Gables] Fla.
ANTIFOULING PROPERTIES OF PESTICIDAL MATERIALS, by Sigmund Miller. Monthly progress rept. for 1-31 Aug 59, on Contract NOa(s) 59-6182-c. Aug 59, 7p. ML 59211.
Order from LC mi$1.80, ph$1.80 PB 150 771

The effectiveness of the chemicals in preventing attachment of the various fouling organisms is listed in descending order of effectiveness. 94 of the 144 chemicals tested were completely ineffective, and have not been included in the table. (See also PB 150 770)

Marine Lab., U. of Miami [Coral Gables] Fla.
ANTIFOULING PROPERTIES OF PESTICIDAL MATERIALS, by Sigmund Miller. Monthly progress rept. for 1-30 Sep 59, on Contract NOa(s) 59-6182-c, Sep 59, 9p. ML 59230.
Order from LC mi$1.80, ph$1.80 PB 150 772

The effectiveness of the chemicals in preventing attachment of the various fouling organisms is listed in descending order of effectiveness. 25 of the 36 chemicals tested were completely ineffective, and have not been included in the table. Confirmatory tests have been conducted on 36 chemicals; results of the confirmatory test are shown immediately below results of the test of each chemical. (See also PB 150 771)

Marine Lab., U. of Miami [Coral Gables] Fla.
ANTIFOULING PROPERTIES OF PESTICIDAL MATERIALS, by Sigmund Miller. Monthly progress rept. for 1-31 Oct 59, on Contract NOa(s) 59-6182-c. Oct 59, 8p. ML 59242.
Order from LC mi$1.80, ph$1.80 PB 150 773

The effectiveness of the chemicals in preventing attachment of the various fouling organisms is listed in descending order of effectiveness. Six of the 18 chemicals tested were completely ineffective, and have not been included in the table. Confirmatory tests have been conducted on 72 chemicals. (See also PB 150 772)

Marine Lab., U. of Miami [Coral Gables] Fla.
ANTIFOULING PROPERTIES OF PESTICIDAL MATERIALS, by Sigmund Miller. Progress rept. for 1 Nov-31 Dec 59, on Contract NOa(s) 59-6182-c. [1960] 13p. ML 60020.
Order from LC mi$2.40, ph$3.30 PB 150 774

The effectiveness of the chemicals in preventing attachment of the various fouling organisms is listed in descending order of effectiveness. Thirty-six of the chemicals tested were completely ineffective, and have not been included in the table. Confirmatory tests were conducted on 90 chemicals. (See also PB 150 773)

Marine Lab., U. of Miami [Coral Gables] Fla.
ANTIFOULING PROPERTIES OF PESTICIDAL MATERIALS, by Sigmund Miller. Progress rept. 1 Jan-29 Feb 60, on Contract NOa(s) 59-6182-c. [1960] 10p.
Order from LC mi$1.80, ph$1.80 PB 150 775

The effectiveness of 36 chemicals in preventing attachment of the various fouling organisms is listed in descending order of effectiveness. Twenty-two of the chemicals tested were completely ineffective, and have not been included in the table. The first evaluation of 36 new chemicals was conducted during the present report period. Descriptions of the chemicals and results of the test follow. Nine of the chemicals were completely ineffective, and have not been included in the table of results. Confirmatory tests were conducted on 18 chemicals. (See also PB 150 774)

Rock Island Arsenal Lab., Ill.
THE EFFECT OF IONIC NICKEL IN HOT ZINC PHOSPHATIZING SOLUTIONS, by Paul G. Chamberlain. 19 Feb 59, 13p. 4 refs. Rept. no. 59-492; AD-210 922.
Order from LC mi$2.40, ph$3.30 PB 152 294

This report released for sale to the public 1 Nov 60.

The effect of nickel ion additions to hot zinc phosphatizing baths on coating weight, corrosion resistance and texture of coating was determined. It was found that as much as 20% increase in coating weight resulted. A slight improvement in corrosion resistance was noted. The texture of the coating was somewhat coarser than the control without nickel. (Author).

Plastics

Fairchild Kinetics Div., Fairchild Engine and Airplane Corp. [New York].
DESIGN MANUAL FOR GLASS REINFORCED PLASTICS IN NAVAL APPLICATIONS. Rept. on Contract NObs-66373. Jan 58, 716p. 31 refs. NAVSHIPS 250-346-3.
Order from OTS $8.00 PB 171 096

Structural plastics are presently being used in the construction of a variety of naval ships, boats and equipment. Successful use of these materials depends upon proper design, fabrication and installation. This manual is provided for general guidance in the design of glass reinforced plastic structures. The design stress curves are not applicable to all structures. They will need to be modified in many instances to suit the particular need of the structure.

Plastics Technical Evaluation Center, Picatinny Arsenal, Dover, N. J.
FLAKE-GLASS LAMINATES, by Allen M. Shibley. State of the Art, Oct 60, 130p. 8 refs. PLASTEC rept. 1.
Order from OTS $2.75 PB 161 947

An evaluation of flake-glass laminates for structural, electrical, and other uses. Methods of manufacturing and testing glass flake are described and illustrated. Compositions of various types of suitable glasses are indicated. Resin coatings and methods of applying these coatings are also described and illustrated. Optimum resin systems are detailed. Methods used for the manufacture of flake-glass laminates are given in detail. Tests of tensile and flexural strengths, and of modulus, are described. Comprehensive data on a wide variety of physical characteristics, as measured by standard and military specifications, are given. (Author)

Rubber and Elastomers

Institute of Rubber Research, U. of Akron, Ohio.
STRESS RELAXATION AND STRUCTURE OF HIGH TEMPERATURE ELASTOMERS, by Maurice Morton, V. R. Allen, and R. D. Gates. Technical rept. no. 6, 1 Sep-30 Nov 59, on Contract Nonr-2573(00). [1959] 51p. 13 refs. AD-231 153.
Order from LC mi$3.60, ph$9.30 PB 150 491

The sol-gel relations were determined for different primary molecular weights of natural rubber. A low-temperature, modified dithio-carbomate-sulfur curing system was used to reduce the uncertainty in the obtained relations caused by degradation during the cure period. It was found that no appreciable degradation occurs during the cure and extraction periods. Fair agreement was obtained between the sol-gel relations for the two types of vulcanizates, i.e. peroxide and accelerated-sulfur. Based on these relations, the ratio of the number of physical to chemical network chains was determined as a function of the primary molecular weight. Excellent agreement was found between these results and the ratio predicted from the sol versus degradation study. It was proposed that the presence in the network of physical chains due to entanglements may have an effect on stress relaxation. Further, it was considered how these entanglements could affect both the rates and shape of the stress relaxation curves To check for possible effects, measurements were carried out with a very sensitive relaxometer. It was found that no appreciable effect was observable, probably because of the more pronounced influence of other variables. Aging of Viton-A vulcanizates at 275°C indicates that the degradative scission process which predominates during the first two hours of aging is later overshadowed by a crosslinking reaction. 4-6-Butyl thiophenol was used successfully to inhibit this crosslinking reaction. The latter reaction also occurs (as would normally be expected) in the aging (at 200°C) of samples of unvulcanized Viton A. (Author) (See also PB 148 600)

Rock Island Arsenal Lab., Ill.
OZONE AGING OF POLYMERS, by Z. T. Ossefort. Rept. no. 3 on Aging of Vulcanized Rubbers. 5 Oct 49, 29p. 3 refs. RIA Lab. no. 49-1236; ATI-65 612.
Order from LC mi$2.70, ph$4.80 PB 152 590

This report released for sale to the public 10 Nov 60.

An apparatus consisting of ozone generator, testing chamber and measuring device for the ozone concentration, is described. Measurement of the effect of ozonation on the various rubber specimens is effected by a decrease in modulus test. The cracking produced by ozone reduces the modulus of the test specimens and this is used as a measure of the degree of ozonation and, hence, can be used to measure the resistance to ozone afforded by various protective coatings. Protective coatings of neoprene, polyisobutylene, pliolite S4 and Vanderbilt Blackout Black were found to be the most resistant to attack by ozone. Rubber components which are prepared for long term storage should be stored, if possible, in an unstressed condition. (Author)

MATHEMATICS

Applied Mathematics and Statistics Labs., Stanford U., Calif.
A CLASS OF DYNAMIC GAMES, by William E. Pruitt. Technical rept. no. 19 on Contract Nonr-225(28) 4 Dec 59, 47p. 5 refs.
Order from LC mi$3.30, ph$7.80 PB 152 175

There is a large class of business and military situations in which decisions must be made on the basis of

certain observed random variables. When these situations are described as games they often bear a striking resemblance to poker. A fixed-point method for the solutions of games of this type was proposed by Karlin and Restrepo in [Annals of Mathematics Study no. 39 (1957), p 337-363.] One of their examples, known as "le Her", indicated the applicability of the method to games in which there is more than one relevant random variable observed by each player. It is the purpose of this paper to examine some further games in which more than one random variable is observed by each player and some of the random variables may be observed by both players. Since the primary interest is in the method of solution, poker models have been chosen to illustrate the method because of their familiarity.

Applied Mathematics and Statistics Labs., Stanford U. Calif.
A GENERALIZED VOTING-GAME, by Marcel F. Neuts. Technical rept. no. 21 on Contract Nonr-225(28). 30 Dec 59, 30p. 3 refs. AD-230 318.
Order from LC mi$2.70, ph$4.80 PB 152 177

A discussion is presented of a simple game over the square, which serves as a model for many competitive situations.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
MEASUREMENT, EMPIRICAL MEANINGFULNESS AND THREE-VALUED LOGIC, by Patrick Suppes. Technical rept. no. 20 on Contract Nonr-225(17). 29 Dec 58, 26p. 13 refs.
Order from LC mi$2.70, ph$4.80 PB 152 053

Applied Mathematics and Statistics Labs., Stanford U., Calif.
THE SOLUTION OF QUEUEING AND INVENTORY MODELS, by Augustus J. Fabens. Technical rept. no. 20 on Contract Nonr-225(28). 7 Dec 59, 33 p. 13 refs; AD-230 328.
Order from LC mi$3.00, ph$6.30 PB 152 176

An approach is investigated for queueing and inventory models which is based on the theory of semi-Markov processes. The method is applicable to a wide variety of models in continuous or discrete time. After 2 basic theorems are developed, the limiting distributions for the models are determined by showing them all equivalent to a batch service queue with Poisson input and then the latter is solved. Waiting time distributions and expected length of busy periods are shown for the queues. The application of the method to finite queues is indicated. (Author).

Behavioral Sciences Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
TABLES FOR MOOD'S DISTRIBUTION: FREE INTERVAL ESTIMATION TECHNIQUE FOR DIFFERENCES BETWEEN TWO MEDIANS, by John H. Bowen and Earl D. Sharp. Rept. on Psychological Research on Human Performance. May 60, 23p. 4 refs. WADD Technical note 60-89.
Order from OTS $0.75 PB 171 078

The report presents tables which can be used to obtain fiducial probabilities and confidence intervals for differences between the medians of two populations. Also included are the formulae, as originally derived by Mood, and an illustrative application of the technique to experimental data which had been obtained by the writers. (Author)

Colorado U., Boulder.
CONVERGENCE REGIONS FOR CONTINUED FRACTIONS AND CERTAIN OTHER INFINITE PROCESSES, by W. J. Thron. Rept. on Contract AF 49(638)100. [1960] 34p. 34 refs. AFOSR-TN-60-1091; AD-243 470.
Order from LC mi$3.00, ph$6.30 PB 152 071

Columbia U., New York.
EXTENSIONS OF SHEAVES OF ASSOCIATIVE ALGEBRAS, by John W. Gray. Technical rept. no. 3 on Contract Nonr-266(57). Jan 60, 14p. 2 refs. CU-3-60-ONR-266(57)-M; AD-238 205.
Order from LC mi$2.40, ph$3.30 PB 148 063

Let X be a topological space, Λ a sheaf of associative algebras over X, and A a sheaf of two-sided Λ-modules considered as a sheaf of algebras with trivial multiplication. The group $F(\Lambda, A)$ of equivalence classes of algebra extensions of Λ with A as kernel has been shown to occur naturally in an exact sequence $\cdots \to H^1(X, A) \to F(\Lambda, A) \to Ext^2(\Lambda, A) \to H^2(X, A) \to \cdots$, where $H^n(X, A)$ denotes the Cech cohomology of X with coefficients in A. The case in which A has a non-trivial multiplication is discussed. Under appropriate hypotheses $F(\Lambda, A)$ is shown to occur in a similar exact sequence, except that in the other terms of the sequence, A must be replaced by the bicenter K(A) of A. (Author)

Columbia U. [New York]
FIRST EMPTINESS OF TWO DAMS IN PARALLEL, by Joseph M. Gani. Rept. on Contract Nonr-266(59). [1959] 21p. 5 refs. CU-12-59-Nonr-266(59) MS; AD-228 114.
Order from LC mi$2.70, ph$4.80 PB 150 522

The probabilities are considered of first emptiness of 2 dams in parallel; both are subject to a steady release at constant unit rate, and fed by a discrete additive input process such that unit inputs are always directed to the dam with lesser content. The problem is equivalent to that of the single dam fed by 2 ordered inputs. A recurrence relation for the probabilities of first emptiness in this process is obtained. Equations for the generating functions of the probabilities are derived, and a formal solution to these is given. A more convenient method of evaluating probabilities of first emptiness is found by reducing the process to an associated occupancy problem. The probabilities of first emptiness for Poisson inputs are then shown to be obtained by a rapid computational procedure. A general formulation is concluded of the problem when the times of arrival for 2 ordered non-negative inputs of random size form a Poisson process. (Author)

Columbia U. [New York]
MARKOV RENEWAL PROCESSES WITH FINITELY MANY STATES, by Ronald Pyke. Rept. on Contract Nonr-266(59). [1959] 43p. 11 refs. CU-11-59-Nonr-266(59) MS; AD-228 117.
Order from LC mi$3. 30, ph$7. 80 PB 150 521

Markov renewal processes having a finite number of states are studied. Explicit expressions are derived for the distribution functions of first passage times, as well as for the marginal distribution function of the corresponding semi-Markov process. Double generating functions are obtained for the distribution functions of the N_j processes. The limiting behaviour of a Markov renewal process is discussed; the stationary probabilities being derived completely. General Markov renewal processes are introduced, and a related stationary process is determined. Several illustrative examples are given. (Author)

Columbia U., New York.
A NOTE ON SUFFICIENCY IN REGULAR MARKOV CHAINS, by J. Gani and B. R. Bhat (U. of California) Rept. on Contract Nonr-266(59). [1959] 13p. 4 refs. CU-14-59-Nonr-266(59)MS.
Order from LC mi$2. 40, ph$3. 30 PB 152 106

The initial state E_α is random, and a slightly more general result is obtained for positively regular chains with initial probabilities $a_\alpha(\theta)$ and transition probabilities $p_{ij}(\theta)$ $(\alpha, i, j = 1, 2, \ldots, s)$.

Columbia U. [New York]
ON THE NUMERICAL EVALUATION OF A CLASS OF MULTIVARIATE NORMAL INTEGRALS, by Harold Ruben. Rept. on Contract Nonr-266(59). [1959] 14p. 10 refs. CU-13-59-Nonr-266(59)MS; AD-229 528.
Order from LC mi$2. 40, ph$3. 30 PB 152 100

An explicit formula is obtained for the probability that each of n normally distributed and equally correlated random variables with zero expectations and unit variances does not fall short of a given value h. The ratio of the required probability to the density at the cut-off point (h, h, . . . , h) is expressed as a power series expansion in $\sqrt{[n/(1+(n-1)\rho)]}\,h$, where ρ is the common correlation. The coefficients in the expansion involve the geometrical moments relative to the plane of symmetry Λ, of a regular (n-1)-dimensional spherical simplex, with dihedral angles arc cos; ρ, Λ being defined as that plane through the centre of the hypersphere (on whose surface the simplex is located) which is orthogonal to the line joining the latter point and the centroid of the simplex. (Author)

Digital Computer Lab., U. of Illinois, Urbana.
NUMERICAL QUADRATURE OVER A RECTANGULAR DOMAIN IN TWO OR MORE DIMENSIONS III. QUADRATURE OF A HARMONIC INTEGRAND, by J. C. P. Miller. Rept. on Contract Nonr-1834(27). 11 Dec 59, 12p. Rept. no. 95; AD-230 863.
Order from LC mi$2. 40, ph$3. 30 PB 152 109

Previous notes have shown that the error term is very much reduced if the integrand f(x, y) is a harmonic function, that is, if $\nabla^2 f = 0$. In this note the case in which high accuracy is attainable with few points is discussed. Expansions for n variables, and more extensive ones for 2 variables are obtained. Special quadrature formulae are obtained and considered. (Author)

Duke U. [Durham, N. C.]
NUMERICAL VALUES OF SOME INTEGRALS INVOLVING BESSEL FUNCTIONS, by D. L. George. Rept. on Contract AF 18(600)1341. July 60, 29p. 4 refs. AFOSR-TN-60-982; AD-243 143.
Order from LC mi$2.70, ph$4.80 PB 152 066

The object of the present paper is to make available tables of numerical values of the integrals S(v, n), C(v, n) for the values:-

$v = 0, \quad n = 0, 1;$
$v = 1, \quad n = -1, 0, 1.$

Analytical expressions for these integrals are derived.

Duke U. [Durham, N. C.]
THE PERTURBATION OF GROUP REPRESENTATIONS, by R. T. Harris, Jr. Rept. on Contract AF 18(600)1341. July 60, 17p. 10 refs. AFOSR-TN-60-983; AD-243 144.
Order from LC mi$2. 40, ph$3. 30 PB 152 067

An explicit method is given for the construction of unitary equivalences for unitary representations of abelian groups having scalar spectral measures absolutely continuous with respect to the Haar measure over the dual group.

Illinois U., Urbana.
THE ZEROS OF ENTIRE FUNCTIONS OF EXPONENTIAL TYPE, by Paul Malliavin (Caen U.) and L. A. Rubel. Rept. on Contract AF 49(638)517. 5 Aug 60, 44p. 25 refs. AFOSR-TN-60-910; AD-243 162.
Order from LC mi$3. 30, ph$7. 80 PB 150 883

In order that there exist a non-null entire function f(z) of exponential type that vanishes on a given sequence $\lambda_0, \lambda_1, \lambda_2, \ldots$ of positive real numbers and satisfies $|f(iy)| \leq \exp(n|y|)$ for all real y, it is necessary and sufficient that there exist a constant K such that if $x \leq y$ then $\lambda(y) - \lambda(x) \leq \log(y/x) + K$, where $\lambda(x)$ is the sum of the reciprocals of those λ_n that do not exceed x. (Author).

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
ON EXISTENCE, UNIQUENESS, AND NUMERICAL EVALUATION OF SOLUTIONS OF ORDINARY AND HYPERBOLIC DIFFERENTIAL EQUATIONS, by J. B. Diaz. Rept. on Contract AF 49(638)228. Sep 60, 31p. 22 refs. Technical note BN-216; AFOSR-TN-60-TN-60-1059; AD-242 860.
Order from LC mi$3. 00, ph$6. 30 PB 150 641

This is a detailed account of an invited lecture delivered at the Sixth Conference of Arsenal Mathematicians, held at Duke University, Durham, North Carolina, June 1, 2, 1960. The general uniqueness theorem for the hyperbolic partial differential equation $u_{xy} = f(x, y, u)$, proved in section 5, is an exact analogue of the general uniqueness theorem for the ordinary differential equation $\frac{dy}{dx} = f(x, y)$ which is proved in section 4. (Author)

Institute of Flight Structures, Columbia U., New York.
NUMERICAL EVALUATION OF CERTAIN INFINITE INTEGRALS, by Sara R. Boley. Technical rept. no. 14 on Contract Nonr-266(20). Oct 59, 9p. 4 refs. CU-14-59-ONR-266(20)-CE.
Order from LC mi$1.80, ph$1.80 PB 150 993

It is the purpose of this note to present a modification for the usual asymptotic series expansion.

Johns Hopkins U., Baltimore, Md.
ON STABILITY IN THE LARGE FOR SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS, by Philip Hartmen. Technical note no. 17 on Contract AF 18(603)41. June 60, 20p. 10 refs. AFOSR-TN-60-656.
Order from LC mi$2.40, ph$3.30 PB 150 646

This paper is concerned with questions of stability of systems of real differential equations $x' = f(x)$ or $x' = f(t, x)$, where $t \geq 0$ and x is a point of a complete Riemannian manifold M^n. The central assumption is that the Hermitian part $\| e_{ik} \|^H$ of the tensor $e_{ik} = g_{im} f^m{}_{,k}$ is negative definite. If $M^n = E^n$ is Euclidean space, this means that the Hermitian part J^H of the Jacobian matrix $J = (\partial f / \partial x)$ is negative definite.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
COSET LEADERS, by Everett C. Dade. Rept. on Contract AF 19(604)5200. 24 Aug 60, 10p. 1 ref. 55G-0027.
Order from LC mi$1.80, ph$1.80 PB 150 509

Lincoln Lab., Mass. Inst. of Tech., Lexington.
GALOIS COHOMOLOGY OF CERTAIN MODULES OVER FORMAL SERIES FIELDS, by Stephen S. Shatz. Rept. on Contract AF 19(604)5200. 8 Sep 60, 33p. 9 refs. 52G-0013.
Order from LC mi$3.00, ph$6.30 PB 150 951

The problem of finding all cyclic p extensions of a field k of characteristic $p > 0$ was essentially solved by E. Witt in 1937 when he published his fundamental paper on what are now known as Witt Vectors. This report gives a cohomological treatment of the problem, and then uses some new results of Tate (unpublished) to obtain the chomology of a certain Galois Group with coefficients in finite modules of p power order.

Lincoln Lab., Mass. Inst. of Tech., Cambridge.
ON $\frac{\sin x}{x}$ SAMPLING IN THE CASE OF NON-BAND-LIMITED FUNCTIONS, by K. R. Johnson. Rept. on Contract AF 19(604)5200. 16 Feb 59, 25p. 2 refs. Technical rept. no. 195; AD-211 215.
Order from LC mi$2.70, ph$4.80 PB 147 588

A theoretical investigation is presented of the use of $(\sin x)/x$ sampling to represent a function f(t) having a Fourier transform $g(\omega)$ such that for large $|\omega|$, $|g|$ and $|dg/d\omega|$ tend to zero as $|\omega|^{-a1}$ and $|\omega|^{-a2}$, respectively, when $a_1 > 2$, $a_2 > 2$. The uniformity of the convergence of the representation as the number of sample points increases is investigated. A rigorous proof of the $(\sin x)/x$ sampling theorem for band-limited continuous functions in L_1 is presented. (Author)

Lincoln Lab., Mass. Inst. of Tech., Cambridge.
STOCHASTIC APPROXIMATION AND "MINIMAX" PROBLEMS, by L. A. Gardner, Jr. Rept. on Contract AF 19(604)5200. 11 Apr 60, 44p. 7 refs. Technical rept. no. 219; AD-238 226.
Order from LC mi$3.30, ph$7.80 PB 150 600

Feedback techniques are studied which automatically adjust system parameters to achieve an ideal system performance. The response of a system to unpredictable inputs is a statistical quantity whose behavior varies with the values of the controllable parameters. A criterion for optimum performance is formulated in statistical terms. Minimum mean-square deviation of output from zero and maximum average output are considered. A procedure that makes system parameter adjustments in accordance with responses at its current parameter settings is called an adaptive process. Such a procedure generates increasingly accurate estimates of the optimum parameter values as system operation continues. A stochastic approximation procedure is investigated for estimating the minimum or maximum of an extreme value function (and not a mean value function). Probability one convergence of the approximation is proved.

Minnesota U. [Minneapolis].
SUMS ARISING IN THE THEORY OF MARKOV CHAINS, by Steven Orey. Rept. on Contract AF 49(638)617. 9 Aug 60, 16p. 6 refs. AFOSR-TN-60-1067; AD-243 767.
Order from LC mi$2.40, ph$3.30 PB 152 289

A recurrent irreducible Markov chain with stationary transition probabilities is considered. Questions of convergence, absolute convergence and summability are investigated.

Minnesota U., Minneapolis.
THE WIENER HOPF EQUATION WHOSE KERNEL IS A PROBABILITY DENSITY (II), by Frank Spitzer. Technical rept. no. 1 on Contract Nonr-710(28). [1959] 19p. 4 refs. AD-229 646.
Order from LC mi$2.40, ph$3.30 PB 152 108

Study is continuing on the integral equation $F(x) = \int_0^\infty k(x - y)F(y)dy$, $x > 0$, where the known kernel function k(x) is assumed to be an even probability density. The result of the equation $\lim_{x \to \infty} \frac{F(x)}{x} = \frac{\sqrt{2}}{\sigma}$, where $\sigma^2 = \int_{-\infty}^{\infty} x^2 k(x) dx$ may be infinite or finite, is strengthened concerning the asymptotic behavior of F(x). Tauberian theorems are employed in a form which is familiar in renewal theory.

Northweatern Technological Inst., Evanston, Ill.
CHANCE CONSTRAINED PROGRAMS WITH NORMAL DEVIATES AND LINEAR DECISION RULES, by A. Charnes and W. W. Cooper (Carnegie Inst. of Tech.) ONR Research memo. no. 28 on Temporal Planning and Management Decision under Risk and Uncertainty, Contract Nonr-1228(10) and Planning and Control of Industrial Operations, Contract Nonr-760(01). Nov 59, 20p. 4 refs. AD-231 475.
Order from LC mi$2.40, ph$3.30 PB 150 482

A class of chance-constrained programming problems, e.g., those involving linear decision rules in independent normal variates is discussed, and their direct equivalence to certain mathematical programming problems is developed. The procedure elides, for this class of problems, the 2-stage factorization of Charnes, A and Cooper, W. W. ["Chance-constrained Programming," Management Sci. 6, no. 1, Oct. 1959]. Preliminary to the development of extensions of this procedure to other classes of variates (or decision rules), a characterization of distributions is obtained in terms of their characteristic (or moment-generating) functions. A simple way of evaluating alterations in quality or risk factors that enter into managerial decisions can be effected for this class of problems. Analytical aids are supplied to management by tightening or relaxing those parts of the constraints while avoiding the twin difficulties that are associated with the ex ante approaches to these problems, e.g., via subjective probability or utility analyses. This either shifts the burden of analysis onto management or requires management to make preliminary judgements in artificially simplified situations without being able to assess their consequences for the problems that are actually of interest. (Author)

Northwestern Technological Inst., Evanston, Ill.
THE DISTRIBUTION OF LINEAR COMBINATIONS OF RANDOM DIVISIONS OF AN INTERVAL, by M. Dwass. ONR Research memo. no. 21 on Temporal Planning and Management Decisions under Risk and Uncertainty, Contract Nonr-1228(10). Nov 59, 9p. 6 refs. AD-230 351.
Order from LC mi$1.80, ph$1.80 PB 150 481

Consider n - 1 independent random variables, each uniformly distributed over the interval (0, 1). The ordered values, $x_1 \leq x_2 \leq \ldots \leq x_n$, of these random variables partition the unit interval into n intervals of lengths $U_1, U_2, \ldots, U_n$. The $[U_i]$ are dependent random variables whose sum is 1. Let $U_{(1)} \leq U_{(2)} \leq \ldots \leq U_{(n)}$ be the ordered values of the lengths U_i. In explicit form, the probability laws are obtained of the random variables, $\sum_{i=1}^{n} a_i U_i$, $\sum_{i=1}^{n} b_i U_{(i)}$. (Author)

Northwestern Technological Inst., Evanston, Ill.
RANDOM CROSSING OF CDF'S, by M. Dwass. ONR Research memo. no. 29 on Temporal Planning and Management Decisions under Risk and Uncertainty, Contract Nonr-1228(10). Jan 60, 12p. 6 refs. AD-237 865.
Order from LC mi$2.40, ph$3.30 PB 148 199

The following is proved: let X_i and Y_i $i = 1, \ldots, n$, be 2n independent random variables, each with the same continuous c. d. f., F(x). Let F_j and G_j, $j = n$, denote the empirical c. d. f.'s of the X_i's and Y_i's, respectively. Let P(n) be the number of times F_j equals F and let Q(n) be the number of times F_j equals G_j. Then, as $n \to \infty$, $\lim P[P(n)/(2n)^p < t] = \lim P[Q(n)/(4n)^p < t] = 1 - (1/\ln t^2)$, where $p = 1/2$.

Northwestern U., Evanston, Ill.
FLUCTUATION THEORY FOR INTEGER-VALUED RANDOM VARIABLES, by Meyer Dwass. Rept. on Contract AF 49(638)877. 1 Sep 60, 15p. 3 refs. AFOSR-[TN]-60-1036; AD-243 194.
Order from LC mi$2.40, ph$3.30 PB 150 652

If $X_1, \ldots, X_N$ are non-negative, integer-valued and interchangeable random variables, then $P(S_m < m, m = 1, \ldots, N) = E(N-S_N)^+$. This theorem is used to derive the distributions of $\max_m (m - S_m)$ and $\max_m (S_m - m)$, $(S_0 = 0)$ where the maximum is taken over 0, 1, . . . , N or over 0, 1, . . . , ad inf.. Some of the results require independence. Some applications are made to suprema of infinitely divisible processes. (Author)

Remington Rand Univac Div., Sperry Rand Corp. Philadelphia, Pa.
MINIMIZATION OF BOOLEAN FUNCTIONS. Final rept. on Contract AF [19](604)5228. Apr 60, 47p. 6 refs. AFCRC-TR-60-156.
Order from LC mi$3.30, ph$7.80 PB 152 049

This paper describes and compares two methods of reducing a Boolean function to simplest normal form by a computer. The two methods examined are (I) Quine's method for obtaining the "prime implicants," followed by Petrick's procedure for finding all irredundant normal equivalents, and (II) Urbano and Mueller's topological method for determining the "essential stars," followed by Petrick's procedure for finding all irredundant normal equivalents. The feasibility of programming the above methods for the Air Force Cambridge computer is investigated, and several possible programs evaluated. Five programs were developed which handle both methods and extensions of these programs to handle more terms or more variables, or both were evaluated. The running times of the two methods were compared, and the possibility of using criteria for comparison other than running time was investigated. (Author).

Syracuse U., N. Y.
INVERSE THEOREMS OF APPROXIMATION, by G. G. Lorentz. Technical rept. on Contract AF 49(638)619. 25 Sep 60, 17p. 8 refs. AFOSR-TR-60-21.
Order from LC mi$2.40, ph$3.30 PB 152 292

This paper contains several theorems which give a lower estimate for the degree of approximation of functions f of a given class by means of linear combinations $P = a_1 g_1 + \ldots + a_n g_n$. The distance from f to P is measured in the C- and the L^1- norm. (Author)

Therm Advanced Research, Ithaca, N. Y.
EXPRESSION AS A LEGENDRE FUNCTION, OF AN ELLIPTIC INTEGRAL OCCURRING IN WING THEORY, by B. O. U. Sonnerup. Rept. on Contract Nonr-2859(00). Nov 59, 18p. 6 refs. TAR-TN-59-1; AD-231 252.
Order from LC mi$2.40, ph$3.30 PB 150 466

An integral that arises in potential theory is shown to be related to half order Legendre functions of the second kind, including a special form of the integral studied by Riegels (Arch. Math. 2;117, 1949-59). Series expansions of these Legendre functions for values of the argument in the neighborhood of unity and much greater than unity are also presented. Recursion formulas and expressions in terms of elliptic integrals are noted. (Author)

Wayne State U., Detroit, Mich.
DESCRIPTIVE CHARACTERISTICS AND ORDER STATISTICS INFERENCE FOR A MODEL WITH RELIABILITY FUNCTION $S^*(\dagger) = \exp[1 - \dagger - \exp(-\dagger)]$ by Andre G. Laurent. Technical rept. no. 6 on Contract Nonr-2575(00). 24 Nov 59, 26p. 3 refs. AD-231 937.
Order from LC mi$2.70, ph$4.80 PB 150 477

Let Σ be a system whose response to the cumulative effect or the increasing intensity X of a stimulus can be described by the X-to-failture probability distribution of Σ; i.e. the probability distribution F(X) of that intensity x of the stimulus which causes Σ to fail. The survival function $S^*(X) = 1-F(X)$ is assumed to have, in terms of the reduced variable t, the analytical expression $S^*(X) = \exp[1-t-\exp(-t)]$ where $t=X/B^*$. The stimulus X is called time or age; t or T is the reduced age; $S^*(X)$ denotes the survival function; $\mu^*(X)$, the mortality rate or failture; $\Theta^*(X)$ the mortality density; E^*_X, the expectancy of life at age X; and $\mathcal{T}^*(X)$, the potential of life at age X. (Author)

Wayne State U., Detroit, Mich.
MINIMUM VARIANCE UNBIASED ESTIMATES. GENERALIZATION OF THOMPSON'S DISTRIBUTION, RANDOM ORTHONORMAL BASES, by Andre G. Laurent. Technical rept. no. 5 on Contract Nonr-2575(00). 10 Nov 59, 34p. 1 ref. AD-231 936.
Order from LC mi$3.00, ph$6.30 PB 150 476

Wayne State U., Detroit, Mich.
ORDER STATISTICS AND STATISTICAL INFERENCE FOR A MODEL WITH RELIABILITY FUNCTION $S(t) = \exp[1+\dagger-\exp(t)]$, by Andre G. Laurent. Technical rept. no. 4 on Contract Nonr-2575(00). 1 Nov 59, 71p. AD-231 641.
Order from LC mi$4.50, ph$12.30 PB 150 496

The present paper is devoted to the use of order statistics in problems of statistical inference that arise under the assumption that the phenomena under study are correctly represented by the Reliability Function $S(t) = \exp[1 + t - \exp t]$, where t is a "reduced variable".

Woods Hole Oceanographic Institution, Mass.
ON THE THEORY OF CHARACTERISTICS, by Robert McKelvey. Rept. on Contract Nonr-891(00). Nov 59, 28p. 3 refs. Ref. no. 59-58; AD-230 599.
Order from LC mi$2.70, ph$4.80 PB 150 514

In the theory of the propagation of linear waves, importance is attached to those surfaces in space-time which can carry discontinuities of the waves. These surfaces are subject to a first order non-linear partial differential equation. The theory of this latter equation is equivalent to a space-time geometrical optics for the wave equation. Singularities of solution surfaces are directly related to the geometrical concepts of caustics and shadow zones. The theory of characteristics for quasi-linear and non-linear first order partial differential equations is given, with special emphasis upon the singularities of solution surfaces. (Author)

Computing Devices

Army Chemical Corps Engineering Command, Army Chemical Center, Md.
PERT: PROGRAM EVALUATION AND REVIEW TECHNIQUE FOR THE ROYAL McBEE LGP-30 COMPUTER. July 60, 90p. Engineering Command rept. ENCR no. 45.
Order from LC mi$4.80, ph$13.80 PB 150 992

This report contains the results of a study undertaken to convert the Booz-Allen-Hamilton Program Evaluation and Review Technique (PERT) for small scale applications to the Royal McBee LGP-30 computer. The report contains presentations on the program function and capabilities, operating instructions, LGP-30 flow chart, symbolic and machine language codes, data input error check list, data tables and LGP-30 sub-routine and data table assembly. (Author).

Computation Lab., Harvard U., Cambridge, Mass.
DESIGN AND OPERATION OF DIGITAL CALCULATING MACHINERY, by Howard Aiken. Final rept. on Contract AF 19(604)4947. 1 Dec 59, 123p. AFCRC TR-60-119; AD-234 295.
Order from LC mi$6.30, ph$19.80 PB 148 259

Contents:
Pattern recognition using correlation
Some aids to the evaluation of a certain integral
Beam sweep matrix computations
Aerodynamic origin of magnus moment
(See also PB 143 026)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
CONTRIBUTIONS TO PERCEPTRON THEORY, by R. David Joseph. Rept. on Proj. Para, Contract Nonr-2381(00). 15 June 60, 108p. 6 refs. Rept. no. VG-1196-G-7.
Order from OTS $2.50 PB 171 093

Perceptrons are a class of brain models which have been introduced in previous reports. There are several ways in which an analysis of a perceptron's ability to associate responses with stimuli may proceed. One approach is to place a distribution over the members of a subclass (in a specific manner) and then to analyze statistically the ability of a randomly chosen member of the subclass to perform a given task. A second approach considers the "optimum" characteristics for the components for perceptrons subject to a given set of constraints, and "optimum" operating procedures for given subclasses of perceptrons. Until this past year, almost all the analytic work done on perceptrons has followed the first approach. Quite recently, some powerful results for the second approach have been ob-

tained for a subclass of perceptrons called simple perceptrons. The purpose of this report is to present the rigorous analyses of the first type which have been obtained, to display the techniques which have thus far proved useful, and to give some additional results of the second type.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
TABLES OF Q-FUNCTIONS FOR TWO PERCEPTRON MODELS, by Frank Rosenblatt. Rept. on Proj. Para, Contract Nonr-2381(00). May 60, 144p. 4 refs. Rept. no. VG-1196-G-6.
Order from OTS $2.75 PB 171 092

This volume contains four sets of tables for Q-functions. These functions have been found to be essential in many quantitative analyses of perceptrons, and may also be of more general interest, since they include cumulative probability distributions for differences of binomial and Poisson distributed random variables.

David Sarnoff Research Center, Princeton, N. J.
AN INTEGRATED BINARY ADDER, by M. E. Szekely, S. M. Marcus and J. T. Wallmark. Scientific rept. no. 3 on Integrated Semiconductor Device Studies, Contract AF 19(604)5561. 15 Aug 60, 20p. 4 refs. AFCRL-TN-60-955.
Order from LC mi$2.40, ph$3.30 PB 152 045

This article describes an integrated binary full adder which uses as its active and passive elements unipolar field-effect transistors. A binary full adder is a computer circuit that adds three binary numbers, X, Y and a carry from a previous stage, C, giving two outputs, one for the sum and one for the carry to the next stage. Each one of these binary numbers may be 0 or 1 corresponding to eight possible combinations as shown by the eight columns of the truth-table in Fig. 1. The design will be developed in terms of conventional circuitry, and then extended to an integrated module. The active element used throughout the adder is the unipolar field-effect transistor (UT) the operation of which is described. The only passive elements used are resistors which are also in the form of unipolar transistors. The logic concept used is direct-coupled unipolar transistor logic (DCUTL) which is also described. (Author)

Electrical Engineering Research Lab., U. of Texas, Austin.
AN ANALOG CORRELATION COMPUTER, by C. E. McCullough. Rept. on Contract AF 19(604)2249. 1 Aug 60, 57p. 12 refs. Rept. no. 6-37; ERD-TN-60-783.
Order from LC mi$3.60, ph$9.30 PB 150 649

This study describes a correlation computer designed to be compatible with the equipment which is presently being used for data handling. The computer obtains its input from magnetic tape, and since the time functions to be analyzed are recorded directly on magnetic tape, correlation analyses may be performed using a minimum of manual or automatic transcription processes. Time functions from a few seconds to several hours in length may be analyzed. Included also is a discussion of the theory involved in correlation analysis, a description of the operation of the computer, and several examples of auto-correlation and cross-correlation analyses which have been performed with this computer. (Author)

Hermes Electronics Co., Cambridge, Mass.
DEVELOPMENT OF A MAJORITY GATE FOR IMPROVING DIGITAL SYSTEM RELIABILITY, by R. Wasserman. Rept. on Contract Nonr-2133(00). 2 Nov 59, 51p. Publication no. M-809; AD-229 364.
Order from LC mi$3.60, ph$9.30 PB 150 484

Efforts were made to develop logical design procedure for the efficient use of redundancy in improving the reliability of digital systems. This called for the development of a highly reliable, simple constructed, majority gate. Requirements and design considerations are presented for the majority gate using magnetic cores as logical building blocks. Logical design principles are presented for the shift register, dynamic flip-flop, logical gate functions, binary counter, comparator, and two input full adder. The 6-core majority gate module and the 9-core majority gate module are discussed.

Institute for Systems Research, U. of Chicago, Ill.
TESTING CONTINUOUS COMPUTERS, ed. by R. C. Mikulich. Rept. on Analysis of Continuous Computers for Flight Simulation, Contract AF 33(616)2797. Feb 58, 208p. 18 refs. WADC Technical rept. 57-622.
Order from OTS $3.50 PB 171 080

A program was initiated to design and develop performance tests for continuous computers. Such tests necessitated investigation of actual operations of continuous computers and previously developed error theories. A mathematical theory of testing continuous computers is given and the differences between component and system testing are delineated. An appropriate component test program, with interpretation and analysis, is proposed. The use and application of system testing is then discussed and criteria for the selection of test problems, their running, and subsequent analysis are established. One chapter is devoted to the operational aspects of a computer, including quantitative measures of repeatability and reliability and qualitative discussions of recordability, adaptability, and convenience. (Author)

Laboratory for Electronics, Inc., Boston, Mass.
RESEARCH IN FERROMAGNETICS. Annual rept. for 1 Sep 58-31 Aug 59 on Contract Nonr-2676(00). [1959] 89p. 20 refs. Rept. no. 570-A1; AD-240 322.
Order from LC mi$4.80, ph$13.80 PB 149 593

Experiments performed on two films of different iron-nickel composition showed that a domain wall can be moved controlledly in a film made from a melt whose composition is in the vicinity of 80-20 Ni-Fe. The field required for domain wall nucleation is 25% greater than the field to move a wall in a permalloy film. Equipment for making measurements of the properties of interest in the investigation of thin magnetic films is described. Simple Bloch and Néel walls are treated by a method utilizing charged sheets. For a permalloy film it is shown that a Bloch to Néel transition occurs at about

250 Å, independent of the film's anisotropy and that the wall energies are primarily by exchange and magnetostatic effects. The theory of these walls is applied to a coercive force calculation. The complex cross-tie wall is analyzed. Three models introduced for calculation purposes are treated. The chain of ellipsoids model indicates that the origin of the wall lies in magnetostatic interactions. The other two models attempt to show how the magnetic interaction produces the cross tie. Utilizing these interactions the cross-tie dimensions are determined. Several Bitter pattern experiments are examined. (Author).

Lincoln Lab., Mass. Inst. of Tech., Lexington.
APPLICATIONS OF BOOLEAN MATRICES TO THE ANALYSIS OF FLOW DIAGRAMS, by R. T. Prosser Rept. on Contract AF 19(604)5200. 22 Jan 60, 11p. 15 refs. Technical rept. no. 217; AD-234 081.
Order from LC mi$2.40, ph$3.30 PB 150 599

An analysis of the structure of flow diagrams such as those associated with computing machine programs, can be given in terms of Boolean matrices. A pair of Boolean matrices is associated with each diagram. The first of these, called the connectivity matrix, contains the topological structure of the diagram, and the second, called the precedence matrix, contains its precedence relations. Elementary computations on these matrices are shown to yield detailed information concerning the internal logical consistency of the flow diagram. Possible applications to automatic compiling and debugging procedures are suggested. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE CALLISCOPE: A VERSATILE ALPHANUMERIC DISPLAY, by K. E. Perry and E. J. Aho. Rept. on Contract AF 19(604)5200. 13 Nov 59, 18p. 1 ref. Technical rept. no. 212; AD-232 164.
Order from LC mi$2.40, ph$3.30 PB 150 598

The calliscope is a digitally controlled alphanumeric and graph display intended for presentation of output data from a digital computer. This display employs a magnetically focused and deflected cathode-ray tube. Spot positioning is accomplished by digital switching of high currents through a low-inductance yoke. Settling time is 20 μsec. Alphanumeric symbols are generated by a calligraphic or spot writing method which synthesizes the X and Y current waveforms necessary to control the motion of the spot. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN INTRODUCTION TO DIGITAL COMPUTING, by Bert F. Green, Jr. Rept. on Contract AF 19(604)5200. 18 Aug 60, 46p. 111 refs. 58 G-0011.
Order from OTS $1.25 PB 171 100

This article provides an introductory description of electronic digital computers and a preliminary guide to programming. It also briefly surveys the uses psychologists have found for computers, and lists some of the practical issues involved in using digital computers. For those wishing additional information, the bibliography lists several texts, and notes the major periodicals in the computing field. Detailed training courses in the use of particular machines are offered by various universities and also by the manufacturers.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
A 6-SYMBOL 7-STATE UNIVERSAL TURING MACHINE, by Marvin Minsky. Rept. on Contract AF 19(604)5200. 17 Aug 60, 8p. 4 refs. 54G-0027.
Order from LC mi$1.80, ph$1.80 PB 150 508

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
INSTRUCTION BOOK. TYPHOON RESOLVERS, 1, 2, 3, 4. Rept. on Contract N383s-80094(02). 1 Apr 53, 47p. Research Div. rept. no. 53-33.
Order from LC mi$3.30, ph$7.80 PB 152 651

This report released for sale to the public 9 Nov 60.

National Bureau of Standards [Washington, D. C.]
DESIGN AND OPERATION OF THE CEILOMETER COMPUTER, by Paul Meissner. Oct 60, 77p. Technical note 64.
Order from OTS $2.00 PB 161 565

The ceilometer computer has been developed to provide a display and electrical readout of cloud-height information for use with an automatic weather station. The computer receives an analog signal from the detector of a rotating-beam ceilometer, and determines the height at which cloud indications occur. A small magnetic storage drum contains ten minutes of cloud-height information which is continuously updated, and these data are analyzed for the following factors: (1) Predominant cloud height over the past ten minutes, (2) Maximum and minimum height at which significant cloud occurrences were observed, (3) Number of cloud observations up to a selected critical altitude. The computer is a wired-program machine constructed of transistorized plug-in packages. Several modes of manual operation have been incorporated for testing and maintenance purposes. (Author)

Remington Rand Univac Div., Sperry Rand Corp., Philadelphia, Pa.
COMPUTER-DEVICE APPLICATIONS OF THIN FERROMAGNETIC FILMS. Final engineering rept. for 15 Mar 59-15 May 60, on Contract AF 19(604)5506. May 60, 30p. AFCRC TR-60-160.
Order from LC mi$2.70, ph$4.80 PB 150 767

This report describes the results of a study of the application of thin ferromagnetic films to computers. Anisotropic, "double threshold, " and "rotating anisotrophy" films were considered for use as logic and memory devices. A plausible explanation of the unique properties of double threshold and rotating anisotrophy films is given in terms of domain walls and impurity atom diffusion. Two NDRO memory devices using double threshold and rotating anisotropy films are described. An "and" gate, an "exclusive or" gate, and three types of full adder using thin films are described

An "and" gate, an "exclusive or" gate, and a NDRO memory element using double threshold films were constructed and evaluated. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
PRELIMINARY STUDY OF THE PROBABILISTIC BEHAVIOR OF A DIGITAL NETWORK MAJORITY DECISION ELEMENTS, by Saburo Muroga. Aug 60, 15p. 1 ref. RADC TN-60-146.
Order from LC mi$2.40, ph$3.30 PB 150 973

A majority decision element is an element in which a finite number of inputs are coupled with one output. The output value is one or zero, depending on the input values. An advantage of elements of this sort is that a single element can represent a fairly complex function. Consequently, the network for a given function can be represented with few elements. In addition, a highly reliable network can be constructed with unreliable elements. This report discusses the probabilistic behavior of a network of elements characterized by a majority decision principle. (Author).

MECHANICS

Fritz Engineering Lab., Lehigh U., Bethlehem, Pa.
LITERATURE SURVEY ON THE ANALYSIS AND DESIGN OF RESTRAINED COLUMNS, by Morris Ojalvo. Rept. on Welded Continuous Frames and Their Components, Contract Nonr-610(03). Dec 59, 34p. 38 refs. Fritz Lab. rept. no. 278.1; AD-233 729.
Order from LC mi$3.00, ph$6.30 PB 152 143

The present report will concern itself only with references that consider failure by excessive bending about one of the principal axes of the column section. It also will be assumed that the column ends do not translate and that the columns are not loaded or restrained except at their ends. In spite of these restrictions on the scope of the investigation, the type of column considered often occurs in tier building design when the columns are clad in a manner that precludes failure by lateral-torsional buckling or when columns are of a cross section having a high torsional rigidity (box and annular sections). This investigation is concerned with the behavior of columns up to the ultimate carrying capacity including effects of partial plastification. (Author)

Institute of Engineering Research. U. of California, Berkeley.
AXISYMMETRIC VIBRATIONS OF SHALLOW ELASTIC SPHERICAL SHELLS, by A. Kalnins and P. M. Naghdi. Technical rept. no. 6 on Contract Nonr-222(69). Nov 59, 18p. 8 refs. Series no. 131, Issue no. 6; AD-230 120.
Order from LC mi$2.40, ph$3.30 PB 150 524

An exact solution within the scope of the bending theory of shells is given for axisymmetric vibrations of thin shallow elastic spherical shells. Specifically, the solution is applied to an investigation of the natural frequencies of the free axisymmetric vibrations of spherical shell segments with various edge conditions. Comparison is drawn with previously known results for transverse vibrations of shallow spherical shells, where the effect of longitudinal inertia is neglected. (Author).

Minnesota U., Minneapolis.
EFFECT OF VISCOELASTIC FOUNDATION ON FORCED VIBRATION OF LOADED RECTANGULAR PLATES, by C. T. Hsu, C. W. Chu, and C. C. Chang. Rept. for May 58-June 59 on Metallic Materials, Contract AF 33(616)6828. July 60, 23p. 8 refs. WADD Technical rept. 60-360.
Order from OTS $0.75 PB 171 071

Forced vibration of a loaded rectangular plate with visco-elastic foundation is treated. Two types of visco-elastic material are considered, Kelvin-Voigt solid and Boltzmann model. Analytic solutions are given for the plate subject to compression and a periodic transverse pressure. A numerical example is worked out for the case of Kelvin-Voigt solid. Some features revealed by the example are (a) With visco-elastic effect, the natural vibration damps out rapidly. (b) There exists a critical damping factor ψ_c. For $\psi < \psi_c$ the damping is oscillatory; otherwise the damping is monotonic. (c) The closer ψ is to ψ_c in magnitude, the faster the damping. (d) The time required for damping is almost independent of the frequency of the periodic loading. (e) The greater the viscosity coefficient μ_f, the smaller the amplitude of vibration. The above statement is obtained from preliminary computations. Further work has to be done before conclusive summary can be made. (Author)

Minnesota U., Minneapolis.
QUASI-ORTHOGONAL MODES OF DYNAMICAL SYSTEMS, by Lawrence E. Goodman and Yellappa C. Das. Rept. for Jan-July 59 on Metallic Materials, Contract AF 33(616)6828. Aug 60, 58p. 6 refs. WADD Technical rept. 60-308.
Order from OTS $1.50 PB 171 070

When energy dissipating devices are inserted at the boundaries the analysis of structural vibration problems becomes difficult. The usual classical methods in such cases yield an infinite set of equations for the coefficients of a modal expansion of the solution. The method developed in this report, gives a finite equation for each coefficient of the modal expansion and thus makes it possible to obtain solutions for structural vibration problems with boundary conditions involving the time derivatives. The structural vibration problem treated is identical with that of the transient analysis of electrical circuits having distributed capacity and inductance and terminated by a lumped resistance. Certain problems in heat conduction also fall within the scope of the method developed. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
ON THE CREEP-STRESS ANALYSIS OF SOME STRUCTURES, by Sharad A. Patel and B. Venkatraman. Rept. on Contracts AF 49(638)302 and [Nonr-839(23)]. June 60, 40p. 8 refs. PIBAL rept. no. 560; AFOSR-TN-60-836; AD-242 414.
Order from LC mi$3.00, ph$6.30 PB 150 416

The present paper considers the analysis of some structures in which the deformations are caused exclusively by creep. The paper begins with a discussion of a uniaxial creep law and its generalizations for the analyses of problems in a triaxial state of stress. Moment-curvature relations are then developed from these laws for

problems in bending, and an elementary device for the inclusion of compressibility effects in creep is briefly discussed. With these as basis, the particular problems considered are, the bending of thin-walled beams, the bending of annular plates, and the stress distribution in a compressible sphere. In analysing these problems, use has been made of the elastic analogue. Further, in some cases, the similarity of creep to plasticity has also been used. In all cases, closed form solutions have been presented. (Author)

Watertown Arsenal Labs., Mass.
ON THE BASIC THEORY OF THIN CYLINDRICAL SHELLS, by Oscar L. Bowie. Rept. on Materials for Lightweight Construction. Sep 60, 25p. 3 refs. Technical rept. no. WAL TR 893.3/3.
Order from LC mi$2.70, ph$4.80 PB 149 295

A three-dimensional solution for cylindrical shells is considered and sets of solutions satisfying the exact equilibrium equations are generated. Systematic procedures for effectively approximating the boundary conditions are derived. Thus, using this approach, conventional thin shell solutions can be extended to moderately thick shells. The solution is carried out numerically for the case of bending moments acting on the ends of a cylinder. (Author)

Aerodynamics and Pneumatics

Air Force Missile Development Center, Holloman AFB, N. Mex.
DEVELOPMENT OF THE NATION'S LEADING TEST-TRACK FACILITY 1956-1960. VOLUME II. HISTORY OF TRACKS AND TRACK TESTING 1949-1960 AT THE AIR FORCE MISSILE DEVELOPMENT CENTER, HOLLOMAN AIR FORCE BASE, NEW MEXICO, by David Bushnell. [1960] 171p. 241 refs. AD-240 889.
Order from LC mi$8.10, ph$27.30 PB 152 802-2

This report released for sale to the public 18 Nov 60.

The present volume, the second of the planned three-volume series on tracks and track testing, is primarily a documented account of the development of Holloman's major track facility, although it includes information related to advances in the state of the art. In addition to covering the physical evolution of the track itself, the volume discusses the parallel problems and accomplishments since 1956 of AFMDC's track organization, in sled design and development, instrumentation and related fields.

Air Force Missile Development Center, Holloman AFB, N. Mex.
ORIGIN AND OPERATION OF THE FIRST HOLLOMAN TRACK. VOLUME I. HISTORY OF TRACKS AND TRACK TESTING AT THE AIR FORCE MISSILE DEVELOPMENT CENTER, HOLLOMAN AIR FORCE BASE, NEW MEXICO, 1949-1956, by David Bushnell. [1959] 134p. 195 refs. AD-231 907.
Order from LC mi$6.90, ph$21.30 PB 152 802-1

This report released for sale to the public 18 Nov 60.

Contents:
Origin of the Holloman high-speed track
Beginnings of track testing
Planning and construction of the original Holloman track
Military hardware on the 3550 ft track, 1950-1956
The Snark program on the Holloman track (June 1950-March 1952)
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Allied Research Associates, Boston, Mass.
NONSTEADY INCOMPRESSIBLE HEAT TRANSFER FOR ARBITRATY BODIES AND ALL PRANDTL NUMBERS, by Theorore R. Goodman. Rept. on Contract AF 49(638)839. 1 Sep 60, 27p. 14 refs. AFOSR-TN-60-843. AD-242 475.
Order from LC mi$2.70, ph$4.80 PB 150 634

The title problem is solved using an integral method, and ignoring viscous dissipation. A partial differential equation is derived which yields as special cases Lighthill's non-uniform heat transfer formula and the nonsteady heat conduction in a slab. The differential equation is then specialized to the nonsteady but uniform heat transfer on a flat plate. Comparisons with other solutions are made when available, and it is shown that the integral method produces accuracy of a few percent in these limiting cases. Finally, the heat transfer formula which has been derived is used to calculate the temperatures in a thin skin subject to a jump in external velocity. (Author)

Army Chemical Research and Development Labs., Army Chemical Center, Md.
GENERAL EQUATION FOR TERMINAL VELOCITY OF FREE-FALLING SPHERICAL DROPS FOR SOLUTION ON AN ELECTRONIC COMPUTER, by Fritz A. Hedman and Richard L. Campbell. July 60, 14p. 5 refs. Technical rept. CRDLR 3000; AD-240 483.
Order from LC mi$2.40, ph$3.30 PB 150 100

An empirical equation, easily differentiated and suitable for use with electronic computers, has been derived that gives the terminal velocities of spherical drops having diameters in the range of 3μ to more than 5500μ. The derivation of the equation made use of equations by Stokes and Newton. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn.]
A MINIATURE WAFER-STYLE PRESSURE TRANSDUCER, by W. E. Smotherman. Rept. on ARO, Inc. Contract AF 40(600)800 S/A 11(60-110). Oct 60, 34p. 2 refs. AEDC-TR-60-11.
Order from OTS $1.00 PB 171 104

Design, operating theory, and performance characteristics of a newly developed variable reluctance differential pressure transducer, the wafer gage, are described. This transducer was designed for use primarily in the arc-heated, Hotshot type, hypervelocity wind tunnels at the Arnold Engineering Development Center. The wafer gage provides a series of pressure ranges from 0-0.5 to 0-5.0 psid by means of interchangeable diaphragms. Although 0-0.5 psid is the lowest range specified for the wafer gage, it is frequently calibrated for full scale output at 0.01 psid, and pressure differentials of 30 microns of mercury can be resolved. Because of the convenient wafer shape and the miniature size of this transducer, it may be used in many applications where larger transducers are not feasible. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
ON THE UNIQUENESS OF SOLUTIONS FOR PASSAGE OF SHOCK WAVES THROUGH DUCTS OF VARIABLE CROSS SECTION, by George Rudinger. Rept. on Project Squid, Contract Nonr-1858(25). Nov 59, 30p. 10 refs. Technical rept. CAL-79-P.
Order from LC mi$2.70, ph$4.80 PB 150 531

If shock waves strong enough to produce supersonic flow pass through a duct of variable cross section, the shape of which is approximated by a single discontinuous area change, a variety of wave patterns may be found. These are unique for particular conditions except for a range of area convergence for which it was recently shown that three solutions exist. Examination of the transient processes that precede the establishment of the final flow suggests, and a general proof confirms, that only one of these solutions can actually be realized if the duct converges monotonically. For more general duct configurations, the other solutions may also be found, but the correct wave pattern may have to be established with the aid of a wave diagram in which area changes are properly taken into account. For configurations with a throat, additional wave patterns may appear both within and outside of the region of ambiguity which then loses its significance. (Author)

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
ANALYTIC SOLUTIONS FOR THE SURFACE TEMPERATURES DUE TO AERODYNAMIC HEATING, by Alvin L. Kaskel. Rept. on Contract AF 49(638)544. June 59, 68p. 22 refs. [AFOSR] TN-60-643.
Order from LC mi$3.90, ph$10.80 PB 150 621

The transform procedures of operational calculus are used to obtain analytical solutions for the surface temperatures of a solid-symmetric airfoil at zero angle of attack, when the heat transfer coefficient and the recovery temperature of the fluid through which the wing is moving can be expressed by polynomials, exponentials, the product of polynomials and exponentials or the sum of polynomials and exponentials. The solution for the surface temperature of a hollow wing in which the inner surface of the wing is insulated is also included, along with an approximate solution for the surface temperatures of the solid wing at small angles of attack. The transform procedures are applied to a set of simultaneous integral equations for the upper and lower surface temperatures of the wing. These equations are obtained by making a heat balance between the heat inflow to the wing from aerodynamic heating and the internal temperature gradients at the upper and lower surfaces of the wing. The temperature gradients are obtained from Fourier's one dimensional heat flow equation by using the principle of superposition and Duhamel's integral to find the temperature distribution inside the wing due to the application of an arbitrary upper and lower surface temperature. For convenience, a special approximation is made to the exact solution for the hollow wing and an example is worked out to show the results that can be expected by using this approximation. The results are compared with an existing exact solution for the hollow wing with the inner surface insulated. (Author)

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
UNSTEADY MAGNETOHYDRODYNAMIC FLOW ABOUT THIN AIRFOILS, by Leon E. Ring. Rept. on Contract AF 49(638)544. June 60, 152p. 24 refs. [AFOSR] TN-60-638; AD-243 016.
Order from LC mi$7.50, ph$24.30 PB 150 620

The theory is developed for the magnetohydrodynamic flow of an incompressible fluid about thin airfoils in non-uniform motion. A uniform magnetic field is applied parallel to the free stream and solutions are obtained subject to the restriction of small perturbations. The effects of viscosity are included, for the most part, only through the application of the usual Kutta condition for lifting airfoils. The general character of the flow is discussed at length. The validity and range of applicability of the infinite-conductivity and moderate-conductivity theories are determined on the basis of an order-of-magnitude analysis. The flow-field for infinite conductivity is changed from the non-magnetic case only through the new transport speed of vorticity; the forces on the airfoil are changed due to surface currents. For the case of the Alfven speed less than the free-stream speed, the airfoil lift and pitching moment are given in integral form for general unsteady-airfoil motion and are given in closed form for harmonic oscillations. The forces at moderate frequencies are found to be larger than the corresponding non-magnetic case. The response to a unit step-function change in the downwash is studied and the asymptotic form of the lift is obtained for small and large time. Using the Oseen approximation, a set of singular solutions with arbitrary conductivity and magnetic field strength are obtained for harmonic oscillations. Limiting forms of these singular solutions are given for low conductivity and for low frequencies. Using these solutions, integral equations are formulated for the case of an oscillating airfoil, which may be a conductor or an insulator. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
A HIGH-ALTITUDE ALTIMETER, by Arthur O. Morse and Harvey M. Nilson. 15 June 60, 34p. 5 refs. TR-623.
Order from LC mi$3.00, ph$6.30 PB 152 312

An altimeter system capable of providing accurate reentry altitude data in multiples of 5000 ft has been designed and developed. It is for use on ballistic nose cones at altitudes between 190,000 and 5000 ft and velocities up to 15,000 fps. The system operates on UHF pulse radar. A preliminary evaluation of flight tests conducted with this equipment indicates performance in close agreement with experimental results and theoretical calculations. Functional, mechanical, and circuitry details of this development are described and illustrated. (Author)

General Applied Science Labs., Inc., Westbury, N. Y.
ON THE AERODYNAMIC NOISE OF A JET, by Sin-I Cheng. Rept. on Contract AF 49(638)194. Apr 59, 59p. 8 refs. GASL Technical rept. no. 148; AFOSR TN-59-1308; AD-233 164.
Order from LC mi$3.60, ph$9.30 PB 148 689

A new model is advanced for analyzing the broad spectrum noise of a turbulent jet. The shear layer bounding the turbulent jet is assumed to play an important role in modifying the quadrupole sound radiation from the interior. To the sound emitting small scale turbulent eddies (with frequencies much larger than those large scale ones, responsible for the intermittent phenomena near the edge of a turbulent jet), the shear layer is laminar and is of an irregular contour, as if the large scale turbulent motions were frozen. The linearized analysis is then applied to the laminar shear layer to relate the acoustic oscillations across it. The concept of geometrical acoustics is generalized to represent the passage of an acoustic ray through a laminar shear layer.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
ON THE ROLLING-UP OF A VORTEX SHEET, by Francis R. Hama and Edward R. Burke. Rept. on Contract AF 49(638)645. Sep 60, 32p. 5 refs. Technical note. BN-220; AFOSR-TN-60-1069; AD-243 734.
Order from LC mi$3.00, ph$6.30 PB 152 047

Validity of the classical result obtained by Rosenhead on the rolling-up of a vortex sheet is examined. His computation is found to be doubtful and does not actually result in the rolling up of the vortex sheet in a simple way. First, smaller time intervals must be used for the step-by-step integration of the nonlinear development of the vortex sheet. Second, redistribution of the vorticity along the sheet, as it undergoes a sine-wave distortion, has to be taken into account. It is then shown that the vortex sheet rolls up in a more regular manner. Strong concentration of the vorticity, however, does not result. Effect of positive or negative background vorticity on the rolling-up formation is also considered. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
ROUGHNESS EFFECT AND CORRELATION OF TWO-DIMENSIONAL WIRE ROUGHNESS IN TURBULENT SHEAR FLOW, by Matthew Stevenson. Technical rept. no. 2 on Effect of Surface Roughness on Turbulent Shear Flow, Contract Nonr-595(07). Dec 59, 33p. 8 refs. Technical note BN-181; AD-231 182.
Order from LC mi$3.00, ph$6.30 PB 152 173

The roughness effect on 2-dimensional turbulent shear flow of wires at various spacing ratio is measured. Except for the largest spacing ratio, the results are restricted to the fully rough region of the roughness effect. By keeping the roughness height constant and varying only the spacing ratio, a simple correlation is found in terms of a power function which agrees closely with Schlichting's equivalent (NACA TM 823, 1937) sand-grain correlation. (Author)

Iowa Inst. of Hydraulic Research, Iowa City.
POTENTIAL FLOW ABOUT BODIES OF REVOLUTION AND SYMMETRIC TWO-DIMENSIONAL FORMS, by L. Landweber. Rept. on Contract Nonr-1611(01). Dec 59, 68p. 13 refs. AD-234 703.
Order from LC mi$3.90, ph$10.80 PB 152 099

A procedure is presented for computing the potential flow about bodies of revolution and symmetric two-dimensional forms in arbitrary states of motion. Solution for general motion is obtained by superimposing the solutions of the boundary-value problems for the different components. Technique consists of formulating each problem as a Fredholm integral equation of the first kind which can be closely approximated, by means of a quadrature formula of moderate order, by a set of linear equations with a matrix having a strong principal diagonal, suitable for solution either by elimination or iteration. For the general motion of bodies of revolution, three such integral equations need to be solved; for the two-dimensional forms, solutions for four potential-flow problems are required, two of which are obtained from integral equations, the remaining two being obtained from the integral equation solution for longitudinal flow by conformal mapping. Method was programmed for the IBM 650. The separate programs for the body of revolution and two-dimensional forms are presented and the application of computer-obtained results is illustrated with several examples. A considerably shortened and somewhat less accurate procedure, suggested for use when an automatic computer is not available, is also illustrated in detail and compared with computer-obtained results. (Author)

Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy).
ON THE INTERACTION BETWEEN STREAM AND BODY IN A FREE-MOLECULE FLOW. PART I: ENERGY EXCHANGES, by Silvio Nocilla. Technical note 15 on Contract AF 61(052)208. June 60, 33p. 11 refs. AFOSR-TN-60-914.
Order from LC mi$3.00, ph$6.30 PB 150 346

The study of the energy exchanges is usually faced by eliminating the unknown energies by the introduction of convenient accommodation coefficients, and then giving to these, in a more or less arbitrary way, certain constant values. The object of this research is to overcome this arbitrariness by defining a precise energy balance on the surface between body and flow, and discussing the derived equations in the three cases of phenomena (i) adiabatic, (ii) with radiation and (iii) with heat transfer. This study, from which also appears

the need of introducing interaction parameters new with respect to the usual accommodation coefficients, allows one the calculation at the re-emission temperature, to obtain a new physical interpretation of the local accommodation coefficient a, to calculate the global accommodation coefficient $\bar{a}$, and to recognize, on the basis of known experimental results, that in the case (iii) the latter assumes values somewhat different from those usually assigned. (Author).

Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy).
SIMULTANEOUS TRANSFER OF MOMENTUM, HEAT AND MASS. PART I: HOMOGENEOUS GASES, by Gianni Jarre. Technical note 16 on Contract AF 61(052)208. July 60, 14p. 11 refs. AFOSR-TN-60-915.
Order from LC mi$2.40, ph$3.30 PB 150 347

The aim of this paper is to study the analogies of momentum, heat and mass transfer for high speed streams of moist gases over surfaces on which the vapor may undergo a change of state. The known results for homogeneous gases subjected to momentum and heat transfer only are referred to. Such results are elaborated and interpreted in a suitable form for the further extension to moist gases. (Author).

Lincoln Lab., Mass. Inst. of Tech., Lexington.
REENTRY PHYSICS PROGRAM. Semiannual technical summary rept. no. 3, 1 Jan-30 June 60, on Contract AF 19(604)4559. 5 Aug 60, 56p. 5 refs; AD-241 226.
Order from LC mi$3.60, ph$9.30 PB 150 606

A major portion of the effort in reentry physics is concerned with field experiments utilizing a special test reentry vehicle. Laboratory and theoretical studies in support of the field experiments are carried on to establish a model for predicting the events that are expected to be observed in the field and to assist in analyzing and interpreting the results that are obtained. These efforts include the study of (a) the flow field about hypervelocity objects, (b) the electronic properties of plasmas, (c) the interaction of electromagnetic radiation with plasmas, (d) emission from plasmas, and (e) microwave and optical measurements on the flow field associated with smaller-diameter objects fired in hyperballistic ranges.

Massachusetts Inst. of Tech., Cambridge.
MOMENTUM AND MASS TRANSFER IN COAXIAL GAS JETS, by Walton Forstall, Jr. and Ascher H. Shapiro. Rept. on Proj. Meteor, Contract NOrd-9661. July 49, 21p. 89 refs. Meteor rept. no. 39.
Order from LC mi$2.70, ph$4.80 PB 152 357

This report released for sale to the public 1 Nov 61.

The mixing at constant pressure of a circular jet with an annular coaxial stream has been studied for conditions of nearly common density and temperature, but differing initial velocities. By using 10 per cent by volume of helium as a tracer in the inner stream, the mixing region was mapped with respect to both material and momentum transfer. It is concluded that material diffuses more rapidly than momentum; that the principal independent variable determining the shape of the mixing region is the velocity ratio of the streams; and that the integral method of Squire and Trouncer, using experimentally determined constants, is adequate for predicting approximate values of concentration and velocity in the mixing region of a jet flowing into a moving medium of the same density. Data for widely different experiments of various investigators show that the turbulent Prandtl and Schmidt numbers are both within ±10 per cent of 0.70, independent of the nature of the experiment and the magnitude of the laminar Prandtl and Schmidt numbers. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
FREQUENCIES OF AN INFINITELY LONG NONCIRCULAR CYLINDRICAL SHELL. PART II. PLANE STRAIN, TORSIONAL AND FLEXURAL MODES, by Jerome M. Klosner. Rept. on Contract Nonr-839(17). Dec 59, 42p. 5 refs. PIBAL rept. no. 552; AD-231 234.
Order from LC mi$3.30, ph$7.80 PB 152 139

A set of frequencies and modes for an infinitely long noncircular cylindrical shell are determined. The noncircular shell is formed so that it has the same circumference as a circular shell of radius r_o; the radius of curvature of the shell is given by $r = r_o/(1+\epsilon \cos 2s)$ where the parameter ϵ is a measure of the noncircularity of the shell and s is the nondimensional circumferential distance. The perturbation technique was used to obtain the frequencies, and terms of order $\epsilon^4[O(\epsilon^4)]$ were retained for the plane strain vibrations. Expressions for the frequencies of the torsional and flexural modes were determined retaining terms of $O(\epsilon^2)$. The modes presented are non-orthogonal and are related to the normal modes of the circular shell only to the extent that the major portion of their displacements are attributed to these original circular modes. This new set of modes can be used to obtain the response of the noncircular shell to an arbitrary forcing function. Numerical examples of the frequencies are included for the plane strain modes and for the primarily torsional and zeroth circumferential flexural modes. The calculations were made for a mean radius to thickness ratio of 91.7 and for ratios of major to minor axis of the shell equal to 1.1 and 1.40, corresponding to an ϵ equal to 0.1427 and 0.5. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
FOREIGN GAS INJECTION INTO A COMPRESSIBLE TURBULENT BOUNDARY LAYER ON A FLAT PLATE, by Nathan Ness. Rept. on Contract AF 04(647)269. Aug 60, 68p. 12 refs. Technical Information Series R60SD410.
Order from LC mi$3.90, ph$10.80 PB 150 802

The distributed injection of a foreign gas into a compressible, turbulent boundary layer in the absence of a pressure gradient is considered. The analysis is performed within the framework of the binary mixture concept, that is, the primary fluid flowing over the surface represents one component while the injected species represents the second. Calculations have been performed for the injection of helium into undissociated air. The results indicate the effect of Mach number on surface shear and energy transfer when distributed light gas injected normal to the surface exists. A comparison with experimental data indicates reasonable agreement over a range of Mach Number. (Author)

Stanford U., Calif.
THERMAL BENDING STRESSES IN SHELLS, by W. Flügge. Final rept. on Contract Nonr-225(16). 10 Nov 59, 28p. 10 refs. Div. of Engineering Mechanics. Technical rept. no. 124; AD-229 109.
Order from LC mi$2.70, ph$4.80 PB 150 853

The research described briefly in this report was concerned with thermal bending stresses in shells. Such stresses may be attributed to two distinctly different causes: Temperature differences within the shell and temperature differences between the shell and other structural elements to which it is connected (e.g. rings or bulkheads). The solutions of these two parts of the thermal stress problem correspond to particular and complementary solutions of the differential equations. Work has been done along both lines, and where it appeared that the thermal stress problem could best be appreciated as a part of the general stress problem, due attention has been paid to the latter.

Hydrodynamics, Hydraulics, and Hydrostatics

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE EFFECTS OF SURFACE TENSION AND VISCOSITY ON THE STABILITY OF TWO SUPERPOSED FLUIDS, by W. H. Reid. Technical rept. no. 29 on Contract Nonr-562(07), Nov 59, 31p. 10 refs. Rept. 562(07)/29.
Order from LC mi$3.00, ph$6.30 PB 150 528

The effect of surface tension on the stability of two superposed fluids can be described in a universal way by a nondimensional "surface tension number" S which provides a measure of the relative importance of surface tension and viscosity. When both fluids extend to infinity, the problem can be reduced to the finding of the roots of a quartic equation. The character of these roots is first analyzed so as to obtain all possible modes of stability or instability. Two illustrative cases are then considered in further detail: an unstable case for which the density of the lower fluid is zero and a stable case for which the density of the upper fluid is zero, the latter case corresponding to gravity waves. Finally, the variational principle derived by Chandrasekhar for problems of this type is critically discussed and it is shown to be of less usefulness than had been thought, especially in those cases where periodic modes exist. (Author)

Compagnie de Recherches et d'Etudes Aeronautiques (France).
CONTROL OF CIRCULATION AROUND A CIRCULAR CYLINDER, by Jean Brocard. Technical status rept. no. 2 on Contract AF 61(052)333. 20 May 60, 28p. AFOSR-TN-60-1015.
Order from LC mi$2.70, ph$4.80 PB 150 368

For this particular study Mr. Gruson has developed an original method which makes it possible to obtain in the water tank, not only qualitative results such as those usually obtained, but also quantitative results such as, in particular, the estimated C_L. This method is described in the present report.

David Taylor Model Basin, Washington, D. C.
BOUNDARY-LAYER INVESTIGATION ON USS TIMMERMAN (EAG 152) (EX-DD 828) by Clifford L. Sayre, Jr. and Ralph J. Duerr. Aug 60, 24p. 10 refs. Rept. 1170.
Order from LC mi$2.70, ph$4.80 PB 150 737

Results of velocity measurements in the boundary layer of USS TIMMERMAN (EAG 152) are presented in this report. Measurements of velocities in the throat of the condenser scoop and the pressure drops across the condenser are also given. A generalized form of Prandtl's equation for the growth of the turbulent boundary layer on a flat plate is derived for use in estimating the boundary layer thickness at large Reynolds numbers. (Author)

Dynamic Developments, Inc., Babylon, N. Y.
PENDULUM FACILITY REPORT, by T. Andrews and R. Smith. Rept. on Contract Nonr-2852(00). Nov 59, 48p. 4 refs. Rept. no. 115.
Order from LC mi$3.30, ph$7.80 PB 150 478

The Pendulum Facility has been designed and constructed to investigate the loading characteristics of various hydrofoil designs. In addition to a facility description, this report presents Pendulum test data obtained on hydrofoils and struts which have been previously tested at the towing tanks of either the Stevens Institute of Technology at Hoboken, New Jersey or of NASA at Langley Field, Virginia. The comparison of such data establishes Pendulum accuracy.

Dynamic Developments, Inc., Babylon, N. Y.
PENDULUM TESTS OF SPECIFIC HYDROFOIL DESIGNS, by T. Andrews and R. Smith. Rept. on Contract Nonr-2852(00). Nov 59, 45p. 2 refs. Rept. no. 116; AD-233 433.
Order from LC mi$3.30, ph$7.80 PB 150 479

Test data are presented on two basic types of hydrofoil. One type is of low thickness ratio, low aspect ratio and of a modified delta plan-form with high sweepback at the leading edge. It incorporates a sharp leading edge and a blunt trailing edge. The second type incorporates a larger thickness ratio and larger aspect ratio, and embodies less sweepback at the leading edge. It employs a streamwise cross section with a parabolic thickness distribution and a blunt trailing edge. Camber is introduced into both types of foil designs. The supporting struts used with the modified delta foils employ a cross section with a parabolic forebody and a tapered afterbody. Forebody and afterbody are separated by a step. The second type of tested foil was supported by a strut which employs a cross section of parabolic thickness distribution over its entire chord and which has a blunt trailing edge. The tests described represent an initial study directed toward the development of fully submerged hydrofoils for operation at cruise speeds between 80 and 100 knots. As such, the tested configurations have employed realistic structural geometries. The blunt trailing edges of struts and foils are vented to the atmosphere as a means of base drag reduction. These tests have been very useful in determining geometry characteristics necessary to obtain smooth load transition between conditions of wetted and ventilated flow on foil upper surfaces.

Gibbs and Cox, Inc., New York.
A LINEARIZED THEORY FOR THE HYDROFOIL OF FINITE SPAN IN A FLUID OF INFINITE DEPTH, by J. P. Breslin. Technical rept. no. 16 on Hydrofoil Research Proj., Contract Nonr-507(00). Jan 54, 67p. 14 refs. AD-24 418.
Order from LC mi$3.90, ph$10.80 PB 152 416

This report released for sale to the public 1 Nov 60.

The fluid motion produced by a foil of finite span is obtained from the free surface theory of Havelock (Proc. Roy. Soc. 118:24-23, 1927). Formulas for the velocity potential are obtained for points at some distance aft of the foil, and formulas which are derived from these expressions for the wave profile, wake velocities, and drag are considered sufficiently simple for engineering use. The analysis showed that the total lift-dependent drag comprises an induced drag and a wave drag. The induced drag is essentially that of a foil moving close to a rigid wall. The wave drag is represented by an integral which expresses the sum of the transverse and lateral wave drag. The integral is a function only of span- and submergence-Froude numbers and approaches a limit which is independent of gravity. The limit is equal to twice the drag increment resulting from a bigplane image. A comparison with total lift-dependent drag from model tests showed reasonable agreement with theoretical results.

Institute of Engineering Research, U. of California, Berkeley.
ON THE MEASUREMENT OF TURBULENT PRESSURE FLUCTUATIONS WITH A TRANSDUCER OF FINITE SIZE, by G. M. Corcos, J. W. Cuthbert, and W. A. Von Winkle. Rept. on Contract Nonr-222(30). Nov 59, 30p. 10 refs. Series no. 82, issue no. 12.
Order from LC mi$2.70, ph$4.80 PB 150 540

The general problem of the mapping of random fields by a linear operator has been treated, in particular by H. W. Liepmann and Uberoi and Kovasnay. The use of transducers of finite size for the measurement of pressure fluctuations within turbulent flows involves a systematic error which is an example of this mapping. The new feature of the problem is the coupling of the time and of the space domain caused by the apparent downstream convection of the pressure field which has been observed in turbulent shear flows. The problem is formulated for a field which is homogenous (but not isotropic) in the relevant coordinate axes and stationary. A model of the downstream convection is introduced and used to derive formulae for the distortion of the three-dimensional spectrum and of the frequency spectrum. For the three-dimensional spectrum, the formalism is that of Uberoi and Kovasnay. For the frequency spectrum, a somewhat more direct approach is presented although the results of Uberoi and Kovasnay are again useful in generalizing the convection model. The results confirm recent measurements which indicate that the frequency spectrum may be considerably in error for the higher frequencies even when the mean square pressure measurements are only slightly affected by the finite size of the transducer. (Author)

Massachusetts Inst. of Tech., Cambridge.
AN APPRAISAL OF THE HYDRAULIC ANALOGUE TO GAS DYNAMICS, by Ascher H. Shapiro. Rept. on Proj. Meteor, Contract NOrd-9661. Apr 49, 21p. 18 refs. Meteor rept. no. 34.
Order from LC mi$2.70, ph$4.80 PB 152 356

This report released for sale to the public 1 Nov 61.

The assumptions of the hydraulic analogue to gas dynamics are reviewed in the light of recent experience, with the aim of assessing the analogue as a practical tool. Some experimental techniques are discussed, and some typical results obtained with a "supersonic water channel" are presented. It is concluded that the water channel is a valuable instrument for making qualitative studies and for making quantitative studies of a comparative nature but does not lend itself to obtaining direct design data. (Author)

Naval Ordnance Lab., White Oak, Md.
STABILITY CRITERIA FOR NUMERICAL SOLUTIONS OF THE NORMAL AND SHOCK REGIONS IN UNSTEADY TWO-DIMENSIONAL CYLINDRICAL LAGRANGIAN FLOW, by Julius W. Enig. 15 Mar 60, 17p. 4 refs. NAVORD rept. 6726; AD-237 718.
Order from LC mi$2.40, ph$3.30 PB 148 178

An application of a method given by von Neumann and Richtmyer (J. Appl. Phy. 21:1950) is used to derive the stability criteria for numerical solutions of the normal and shock regions in unsteady two-dimensional cylindrical Lagrangian flow. The shocks are computed by the psuedo-viscosity method for one-dimensional flow; this method has been applied to the computation of unsteady shock propagation in two-dimensions. By introducing a small perturbation into the hydrodynamic differential equations, the set of equations of first variation are obtained. The stability criteria are obtained by performing a stability analysis on the finite difference representation of the dominant equation of the set of equations of first variation. Utilization in computational programs shows that the derived criteria lead to stable solutions. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
SOME VARIATIONAL PRINCIPLES FOR PROBLEMS IN HYDRODYNAMIC AND HYDRODYMAGNETIC STABILITY, by R. C. DiPrima. Rept. on Contract Nonr-591(08). 13 Nov 59, 25p. 17 refs. RPI MathRep no. 28; AD-229 361.
Order from LC mi$2.70, ph$4.80 PB 150 871

Contents:
The Taylor problem
The inhibition of convection by a magnetic field
The Taylor problem with an axial magnetic field
Direct series solution

Royal Inst. of Tech. (Sweden).
TRANSITION IN BIREFRINGEMENT FLUID FLOWS, by E. Rune Lindgren. Final rept. for 1 Jan 57-31 Mar 59 on Contract AF 61(514)120. 23 June 59, 5p. 4 refs. AFOSR-TR-59-135.
Order from LC mi$1.80, ph$1.80 PB 150 331

The aim of the present study has been to try to remove apparent discrepancies between findings of various authors and also if possible to add facts about the transition process which may have escaped previous investigators. Only a general survey of the experimental technique and the findings are presented here.

Woods Hole Oceanographic Institution, Mass.
AN EXPERIMENTAL STUDY OF SHIP MOTIONS, by Wilbur Marks. Technical rept. on Contract Nonr-1168(00). Nov 59, 12p. 16 refs. Reference no. 59-59; AD-228 212.
Order from LC mi$2.40, ph$3.30 PB 150 842

A linear theory of ship motion prediction was presented. An experimental verification of the theory was described for pitch and heave and in head and following seas. Improvements of certain coupling terms in the equations of motion are presented. The pitch and heave of the launch Risk (36-ft long) were recorded for a specific set of test conditions and analyzed in terms of the energy spectra of these motions. From the physical and geometrical properties of the vessel, the particular amplitude response operators in these degrees of freedom were computed with and without the assumption of coupling. The observed spectra were compared to the 2 computed sets of spectra. Results show that: (1) the linear prediction scheme agrees reasonably well with observation; and (2) the linear prediction scheme yields motion statistics which in general agree more nearly with observation. (Author)

Statics, Kinematics, and Kinetics

Brown U. Div. of Engineering, Providence, R. I.
ON ANOMALIES IN THE MEASUREMENT OF THE COMPLEX MODULUS, by S. R. Bodner. Technical rept. no. 16 on Contract Nonr-562(20). Dec 59, 32p. 9 refs; AD-230 329.
Order from LC mi$3.00, ph$6.30 PB 152 170

Resonance tests on aluminum and lead specimens reveal multiple resonance peaks, i.e. resonances in addition to the natural frequencies of the system, when the specimens are subjected to uniform static stress or contain residual stresses. The multiple resonance peaks can be interpretated in the same manner as the resonance dispersions observed by E. R. Fitzgerald (Phys. Rev. 108:3, Nov 1957). Experiments were conducted which show that the phenomenon is directly related to the presence of either residual or applied static stresses. A tentative explanation of the phenomenon is presented which is based upon the mathematical representation of the experiments by Mathieu type equations. The additional resonances are interpreted as instabilities of the solution of the Mathieu equation. (Author)

Bureau of Ships, Washington, D. C.
PROCEDURE FOR TORSIONAL VIBRATION ANALYSIS OF MULTIMASS SYSTEMS, by Richard J. Gariboldi. Research and development rept. 15 Dec 53, 93p. 7 refs. Rept. no. 371-V-19.
Order from LC mi$5.40, ph$15.30 PB 152 681

This report released for sale to the public 16 Nov 60.

The object of this report is to present a general procedure for analysis of the torsional vibration characteristics of multi-mass systems. Technical texts, papers, and reports were drawn upon for data and information. No attempt has been made to present all possible methods of calculation or to derive all equations. Rather, the steps are explained as briefly as possible with references to the literature given for a more thorough study. The only original work in this presentation is the compilation of a systematic procedure of analysis. Procedure is presented in the sequence ordinarily followed in analyzing the torsional characteristics of a system. (Author)

J. G. Engineering Research Associates, Baltimore, Md.
VIBRATIONS OF THICK SHELLS IN A VACUUM AND IN AN ACOUSTIC MEDIUM. PART II. AXIALLY SYMMETRIC VIBRATIONS OF A THICK CYLINDRICAL SHELL IN AN ACOUSTIC MEDIUM, by Joshua E Greenspon. Technical rept. no. 3 on Contract Nonr-2733(00). Nov 59, 25p. 6 refs. AD-231 422.
Order from LC mi$2.70, ph$4.80 PB 150 480

The dynamic behavior of infinitely long thick cylindrical shells surrounded by water is investigated. The shell is excited by axially symmetric forces. Curves are presented which give the forced vibration amplitude and acoustic pressure in the water as a function of frequency for various modes of vibration of the cylinder. The application of the analysis to deep sea sound sources and transducers is discussed. (Author) (See also PB 145 249)

Rensselaer Polytechnic Inst., Troy, N. Y.
WELDING ASPECT OF SLIDING FRICTION BETWEEN UNLUBRICATED SURFACES, by F. F. Ling. Final rept. on Contract AF 49(638)67. 30 June 60, 44p. 30 refs. AFOSR-TR-60-117.
Order from LC mi$3.30, ph$7.80 PB 150 952

This report abstracts materials from five previous technical notes written for the project on the welding aspect of friction for unlubricated metallic surfaces. It also shows in detail a theoretical and experimental investigation of adhesion in which the coefficient of adhesion is related to two important parameters: activation energy of the process and a time exponent, both of which are dependent on the degree of cleanliness of the surfaces. (Author)

METALLURGY

Curtiss-Wright Corp., Caldwell, N. J.
RESEARCH ON PROPERTIES OF HIGH STRENGTH MATERIALS SUITABLE FOR HIGH TEMPERATURE APPLICATIONS, by Harold N. Cummings, Foster B. Stulen, and William C. Schulte. Rept. for May 59-June 60 on Materials Applications, Contract AF 33(616)6552. July 60, 61p. 7 refs. WADD Technical rept. 60-240.
Order from OTS $1.75 PB 171 060

bars of iron-molybdenum alloys, intended for study as to suitability for ball bearings at temperatures up to 1000°F, were found to be so non-homogeneous and brittle that specimens could not be machined from them. High temperature torsion tests of relaxation were made to study the suitability of two alloys, M-1 tool steel and Inconel X, for springs at 1000°F, and of two alloys, Waspalloy and Udimet 500, for springs at 1500°F. Alternating torsion of ±10 ksi, superimposed on an initial steady stress of 25 ksi, was applied to specimens of each alloy. Inconel X lost about 10 to 15 percent of the steady load in about 100 hours. The three other alloys relaxed two to three times as much when tested at the respective temperatures mentioned above. (Author)

Naval Research Lab., Washington, D. C.
ELEVATED TEMPERATURE DIFFUSION IN THE SYSTEMS Nb-Pt, Nb-Se, Nb-Zn, Nb-Co, Ni-Ta, AND Fe-Mo, by R. E. Seebold and L. S. Birks. Interim rept. 19 Sep 60, 13p. 6 refs. NRL rept. 5520.
Order from OTS $0.50 PB 161 767

The electron probe microanalyzer has been used to determine the composition and extent of phases occurring in bimetal diffusion couples at 1100°C. A total of eighteen phases were determined in six binary systems: Nb-Pt, Nb-Se, Nb-Zn, Nb-Co, Ni-Ta, and Fe-Mo. In all cases the phases are stoichiometric and expressible in small whole numbers. The Nb-Se and Nb-Zn systems are somewhat alike in their phase formations in that Nb-Se exhibits Nb-Se, Nb_2Se_3, and Nb-Se_2 while Nb-Zn produces Nb-Zn, Nb_2Zn_3, $NbZn_3$. Diffusion between niobium and platinum to form Nb_3Pt, NbPt, $NbPt_2$, and $NbPt_3$ would seem to preclude prolonged use of platinum thermocouples in contact with niobium at 1100°C. The only phases produced in the Nb-Co system are previously unreported in the literature and are Nb_3Co_2 and $NbCo_4$. This system also exhibited an extended region containing about 5 weight percent niobium in cobalt in agreement with the solubility limit shown in existing phase diagrams. Ni-Ta diffusion produced zones which showed strong cracking and grain formation. The phases $TaNi_3$, $TaNi_2$, TaNi, and Ta_3Ni_2 comprised the zones, with pure tantalum precipitating in the $TaNi_2$ phase on cooling from 1100°C. Fe-Mo produced only one phase: Mo_2Fe_3. (Author)

Naval Research Lab., Washington, D. C.
HIGH TEMPERATURE OXIDATION OF IRON-CHROMIUM BINARY ALLOYS IN WATER VAPOR. PART 1: A PRELIMINARY STUDY OF THE MECHANISM OF OXIDATION OF IRON-CHROMIUM BINARY ALLOYS IN WATER VAPOR, by C. T. Fujii and R. A. Meussner. Final rept. on phase 1. 21 Sep 60, 27p. 22 refs. NRL rept. 5506.
Order from OTS $0.75 PB 161 696

The oxidation of a series of iron-chromium binary alloys in a water vapor-argon atmosphere at high temperatures was investigated. The chromium contents of the alloys were 5, 10, 15, 20 and 25 percent and the oxidation temperatures were 700°, 900°, and 1100°C. Powder x-ray diffraction methods and metallographic techniques were used to identify the oxides that were present in the scales formed on the alloy. Generally, the scales that formed on each specimen could be conveniently divided into three parts. There is an outer layer of wüstite, a two-phase inner layer composed of wüstite and a mixed Fe-Cr oxide, and a subscale. Correlations between chromium concentration of the alloy, temperature of oxidation, weight gain, oxide composition, and the microstructure of the oxide layers are presented. Weight gain versus time plots indicate that at 700° and 900°C the oxidation follows a parabolic curve, whereas the rate at 1100°C is linear. A possible mechanism for the oxidation process is suggested in the form of wüstite decomposition at the outer-inner scale layer boundary, giving rise to Fe^{+2} diffusion to the outer layer and O^{-2} diffusion to the alloy-oxide interface. (Author).

Office of Technical Services, Dept. of Commerce, Washington, D. C.
LIQUID METALS. Aug 60, 10p. 179 refs. OTS Selective Bibliography SB-424.
Order from OTS $0.10 OTS SB-424

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. This bibliography includes reports added to the OTS collection during the period 1950 to September 1960.

Watertown Arsenal Labs., Mass.
A COMPARISON OF SHEAR STRENGTH VALUES OBTAINED FROM THREE TYPES OF SHEAR TESTS, 7075-T6 ALUMINUM, by Armando A. Iannelli. Oct 60, 15p. Technical rept. no. WAL TR 119/1.
Order from OTS $0.50 PB 161 989

Sheet, punch and double shear tests have been carried out to establish a comparison of shear strength values obtained by the three methods. The material used in the investigation is 7075-T6 aluminum. For each type of shear test the specimen sizes have been varied. The effect of size on shear strength values is presented. (Author)

Watertown Arsenal Labs., Mass.
ETCH PITS IN PYROLYTIC GRAPHITE, by Aram Tarpinian and George E. Gazza. Rept. on Materials for High Temperature Uses. Oct 60, 11p. 6 refs. Technical rept. no. WAL TR 130.5/1.
Order from LC mi$2.40, ph$3.30 PB 150 917

The observation of pits in pyrolytic graphic after ion bombardment etching is described and their similarity to dislocation etch pits is speculated. Evidence of etch pit multiplication in the form of slip line segments and low angle tilt boundaries is presented. (Author)

Ferrous Metals

American Brake Shoe Co., Mahwah, N. J.
DEVELOPMENT OF LOW ALLOY STEEL COMPOSITIONS SUITABLE FOR HIGH STRENGTH STEEL CASTINGS, by Hugo R. Larson, Ronald C. Campbell, and Herbert W. Lloyd. Rept. for May 59-May 60 on Metallic Materials, Contract AF 33(616)6485. July 60, 75p. WADC Technical rept. 59-63, Part II.
Order from OTS $2.00 PB 171 065

A study was made of heat treatments and compositions for optimum properties in heavy sections of low alloy heat treatable steels and a 5% Cr air hardening steel. The influence of high purity melting stock was investigated. Fatigue testing was also performed. Alloy variations of the 5% Cr steel were studied, and elevated temperature properties determined. The effect of feeding distance and soundness on properties of the 5% Cr steel was investigated. Production heat data was analyzed and exhibited good reproducibility as well as superior properties in high purity heats. (Author).

Armour Research Foundation, Chicago, Ill.
STUDY OF FATIGUE PROPERTIES OF ULTRA-HIGH STRENGTH STEEL, by Harvey B. Nudelman and John P. Sheehan. Rept. for Mar 59-Feb 60 on Metallic Materials, Contract AF 33(616)6290. June 60, 65p. 3 refs. ARF 2172-6; WADD Technical rept. 60-120.
Order from OTS $1.75 PB 171 056

A temper-resistant, high-strength steel was investigated with reference to fatigue strength. This alloy was prepared by two different melting techniques. The first method consisted of induction melting in air using standard deoxidation techniques. The second method involved the application of a special deoxidation practice to induction melting; silicon-free steel was deoxidized with carbon and aluminum to minimize the presence of silicate inclusions. These alloys were tested in fatigue using the Prot accelerated method. The results of the samples melted with standard practice indicated that fatigue strength is improved slightly by tempering at elevated temperature. The application of a special melting process showed that a very significant increase in the Prot fracture stress to ultimate tensile strength ratio (E_p/UTS) can be obtained by eliminating the presence of silicon and deoxidizing with carbon and aluminum. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
DESIGN INFORMATION ON 17-7 PH STAINLESS STEEL FOR AIRCRAFT AND MISSILES, by R. J. Favor, O. L. Deel, and W. P. Achbach. Rept. on Contract AF 18(600)1375. 23 Sep 60, 37p. 7 refs. DMIC rept. 137.
Order from OTS $1.00 PB 151 096

Elevated-temperature design curves for short-time ultimate tensile strength, tensile yield strength, compressive yield strength, ultimate shear strength, bearing ultimate strength, and bearing yield strength are presented. These curves have been based on a number of published and unpublished reports and papers. Data are summarized in Appendix A in a format recommended for MIL-HDBK-5 (Superseding ANC-5), Strength of Metal Aircraft Elements. Appendix B contains summary plots of substantiating data from which design allowable strengths were derived. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SOME PHYSICAL PROPERTIES OF MARTENSITIC STAINLESS STEELS, by J. G. Hoag and D. B. Roach. [Rept. on Contract AF 18(600)1375]. 28 Sep 60, 31p. 24 refs. DMIC memo. 68.
Order from OTS $0.50 PB 161 218

Metals and Ceramics Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
THE STATUS OF RESEARCH AND DEVELOPMENT FOR HIGH STRENGTH AIRCRAFT STEELS, by E. M. Kennedy, Jr. Rept. for 1956-1959 on Metallic Materials. July 60, 36p. 15 refs. WADC Technical note 59-326.
Order from OTS $1.00 PB 171 077

New aircraft and missile developments have required the development and use of structural steels having optimum strength and ductility over a wide range of temperatures. In this survey an attempt is made to point up to some of the significant areas of investigation in which efforts are being expended toward developing and improving steels having tensile strengths in excess of 260,000 psi. In order to complete the survey of the field of interest, the sources known to have research and development interest in this area were contacted either by personal visitation or through official correspondence. The results of the contacts made were gratifying and the many investigations and studies being carried on are commented upon in the text of this report. (Author)

Naval Research Lab., Washington, D. C.
VACUUM INDUCTION MELTING: OXYGEN AND CARBON IN IRON, by J. E. Srawley. Final rept. on phase 1. 21 Sep 60, 20p. 5 refs. NRL rept. 5516.
Order from OTS $0.50 PB 161 764

Oxygen was removed from vacuum induction melts of electrolytic iron to a limiting level of the order of 20 parts per million (ppm) by means of carbon additions. The initial oxygen contents were about 200 to 300 ppm; a minimum of about 450 ppm of carbon was required to lower the oxygen contents to 20 ppm. Excess carbon reacted with the crucible materials, which resulted in a loss of about 10 percent of the carbon added during heats of 4 to 5 hours duration. Of the three crucible materials used, alumina appeared to be distinctly less reactive to carbon addition than zirconia or magnesia. In the absence of carbon the oxygen contents of dip samples taken from the melts remained substantially constant throughout the heats. The usefulness of leak-up rate measurements for process control is discussed and the features of leak-up rate charts are described. (Author)

Rutgers [State U.] New Brunswick, N. J.
INHIBITION OF HYDROGEN EMBRITTLEMENT DURING PICKLING, by Robert H. Anderson. Quarterly progress rept. no. 5, 1 Jan-31 Mar 57, on Contract DA 30-069-ORD-[1689]. [1957] 17p. AD-136 254
Order from LC mi$2.40, ph$3.30 PB 152 680

This report released for sale to the public 16 Nov 60.

Hydrogen evolution and concomitant dissolved iron have been determined for the reaction of 1095 steel with 4.8 N HCl inhibited with DHQ (I), hexamine, and a combination of these two inhibitors. For 0.5% hexamine the number of millimoles of hydrogen evolved is from 10 to 15% less than the number of millimoles of iron dissolved. The rate of hydrogen evolution does not vary markedly with time in the solutions containing 0.15% DHQ; but in 0.5% hexamine solution the rate decreases by a factor of 5 over a period of 15 hours. A

solution made by immediately diluting 5 g each of p-toluidine and hexamine to 1 liter with 4.8 N HCl was shown to be no better as an embrittlement inhibitor than the inhibited acid of U. S. Army Specification No. 4-105, F-4a(2). Also the embrittlement inhibition did not improve over a 58 day period of standing. The new compound, EtDHQ (II), was tested for embrittlement and metal attack inhibition in combination with hexamine. No significant differences were found between it and the combination of DHQ and hexamine in these two properties. When tested in combination with DHQ, Moore Fatigue tests indicated that acetaldehyde was not as good as hexamine, in its embrittlement inhibition properties. (Author) (See also PB 145 503)

Light Metals

Lockheed Aircraft Corp., Sunnyvale, Calif.
BERYLLIUM CRACK PROPAGATION AND EFFECTS OF SURFACE CONDITION, by C. O. Matthews, M. I. Jacobson and others. Rept. for 1 July 58-31 Dec 59 on Metallic Materials, Contract AF 33(616)5978. July 60 197p. 13 refs. WADD Technical rept. 60-116.
Order from OTS $3.00 PB 171 088

The mechanical properties of beryllium sheet with various surface finished were investigated. The best properties were obtained on sheet which had been etched to remove surface defects caused by machining. Ductility was low in all cases, being limited by the presence of notches and by preferred orientation in the sheet. Ductility was increased by heating to 400° to 600°F. The fatigue endurance limit was as high as the static tensile strength, and was improved by etching. Impact tests were found to be most suitable for distinguishing between various surfaces. Theoretical analyses were made of the effect of including residual stress in the Griffith crack theory, and of the dynamic stress at the leading edge of a crack in a uniaxially stressed plate. (Author)

New York U., N. Y.
INVESTIGATION OF CREEP BUCKLING OF COLUMNS AND PLATES. PART II. CREEP BUCKLING EXPERIMENTS AND COLUMNS OF Ti-7Al-4Mo TITANIUM ALLOY, by Ralph Papirno and George Gerard. Rept. for May 59-Feb 60 on Ceramic and Cermet Materials, Contract AF 33(616)5807. July 60, 54p. 3 refs. SM 60-6; WADC Technical rept. 59-416, Part II.
Order from OTS $1.50 PB 171 082

Creep buckling and short time buckling experiments have been performed on columns of Titanium Alloy Ti-7Al-4Mo with simulated simple support and fixed end boundary conditions. Both end shortening and central deflection were recorded autographically during loading and during creep. Elevated temperature properties of the test material had previously been determined from specimens taken from 3/16 inch thick stock and these were augmented by tests on 3/8 inch thick stock since the mechanical properties and structure were significantly different for the two thicknesses. The excellent creep properties of the test material indicate that creep buckling tests must be conducted at 950°F or higher for creep buckling to occur in reasonable times at stress levels below the short time compressive yield strength. Since only a narrow range of test conditions is available for creep buckling experiments with this material, column tests were conducted L'/ρ of approximately 40 at 950°F. (Author) (See also PB 161 488)

Nonferrous (except light) Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PHYSICAL AND MECHANICAL PROPERTIES OF THE COBALT-CHROMIUM-TUNGSTEN ALLOY WI-52, by F. R. Morral and H. J. Wagner. [Rept. on Contract AF 18(600)1375]. 22 Sep 60, 20p. 2 refs. DMIC memo. 66.
Order from OTS $0.50 PB 161 216

WI-52 was designed for gas-turbine components requiring high-strength properties in the 1000 to 2000 F temperature range. It has been used primarily as a first-stage turbine vane, supplanting the older X-40 (HS 31) alloy. Above 1800 F it may be useful in applications requiring resistance to thermal shock, fatigue, and oxidation, but with lower strength requirements. It is available only in the form of castings.

Illinois Inst. of Tech., Chicago.
ENERGY CHANGES AND ISOTHERMAL KINETICS OF ORDERING IN Au_3Cu, by Francois d'Heurle and Paul Gordon. Technical rept. no. 4 on Contract Nonr-1406(03). Nov 59, 40p. 24 refs; AD-229 737.
Order from LC mi$3.00, ph$6.30 PB 150 470

The order-disorder transformation in Au_3Cu is a reversible transformation with a critical temperature of $212 \pm 1°C$ for 72.5 atomic per cent cold alloy. Long-range order formation below the critical temperature has been observed to have three-stage isothermal kinetics and short-range order formation above the critical temperature two-stage kinetics. The first stage of long-range ordering appear to have kinetics similar to the first stage of long-range ordering, indicating that initially the mechanism of the reactions are alike. A gradual transition from three-stage to two-stage kinetics takes place as the temperature of isothermal ordering is raised through the critical temperature. Contrary to theoretical expectations for AB_3 type alloys no latent heat was found at the critical temperature. The apparent lack of agreement with theory, together with the degree of the transition has been discussed. From the experimentally measured changes in internal energy during ordering, a total internal energy change of approximately 390 calories per mole between a completely disordered and completely ordered sample has been estimated. In quenched samples the rates of ordering at low temperatures have been revealed to be surprisingly fast. The rates found in such samples at about 100°C were more than ten thousand times greater than would be expected from the rates observed near 190°C. It appears safe to conclude that this phenomenon is due to the quenching-in of lattice defects, presumably vacancies as suggested by a measure of the energy of motion of these defects. (Author)

John Carroll U., Cleveland, Ohio.
PHYSICAL PROPERTIES OF GALLIUM, by Harold J. Murphy. Technical rept. no. 2 on Contract Nonr-2577(01). 15 Dec 59, 49p. 60 refs. AD-230 598.
Order from LC mi$3.30, ph$7.80 PB 152 151

The report contains tables of available data on mechanical, thermal, electrical, magnetic, optical, atomic, and crystallographic properties of this element. In addition, brief qualitative descriptions of various characteristics of gallium of special interest to the experimentalist are included. (Author)

Research Chemicals, Inc., Burbank, Calif.
THE METALLURGY OF YTTRIUM AND THE RARE EARTH METALS. PART I. PHASE RELATIONSHIPS, by Bernard Love. Rept. for Oct 58-Oct 59 on Metallic Materials, Contract AF 33(616)5905. May 60, 246p. 28 refs. WADD Technical rept. 60-74, Part I.
Order from OTS $3.50 PB 171 085

Partial constitutional diagrams were established for the systems Er-Ti, Y-Ti, Er-Cu, Y-Cu, Er-Sn, Y-Sn, Er-Co, Y-Co, Er-Zr, Gd-Zr, V-Er, V-Y, Cr-Er and Cr-Y. Compounds are formed in the copper, tin and cobalt systems. Vanadium forms extensive (and chromium forms limited) liquid immiscibility regions with erbium and yttrium. Eutectics are formed at the rare earth ends of all systems. Terminal solubility of all elements (except zirconium) in the rare earths, and of the rare earths in vanadium and chromium is low. Zirconium is appreciably soluble in both alpha and beta zirconium. The zirconium-yttrium and -gadolinium systems are similar except for lower solubilities. Ytterbium forms a compound with beryllium. No eutectic is observed at the beryllium end, and the solubility is low. (Author)

Research Chemicals, Inc., Burbank, Calif.
THE METALLURGY OF YTTRIUM AND THE RARE EARTH METALS. PART II. MECHANICAL PROPERTIES, by Bernard Love. Rept. for Oct 58-Oct 59 on Metallic Materials, Contract AF 33(616)5905. June 60, 73p. 8 refs. WADD Technical rept. 60-74; Part II.
Order from OTS $2.00 PB 171 086

Tensile, compression, fatigue, and impact properties were determined for rare earth metals and alloy systems. Cast yttrium, eribum and dysprosium can be cold worked to improve mechanical properties. All are easily swaged at 980°C. The resulting structures are uniform and dense. Strength and ductility properties are improved over the cast condition. The cast rare earth metals are notch sensitive. Fatigue endurance limits are approximately 40-50% of the corresponding ultimate tensile strengths. Zirconium enters into solid solution in erbium and results in marked tensile strengthening. Dispersed, second phase zirconium also contributes to hardening. Recrystallization of erbium, cold worked 60%, occurs at approximately 1100°C; yttrium at approximately 900°C. Dysprosium and scandium were purified by vacuum distillation. Attempts to purify yttrium, erbium, and dysprosium by electron beam melting were not successful. Carbon deoxidation procedures decreased oxygen content slightly. (Author) (See also PB 171 085)

Sylvania Research Labs., Bayside, N. Y.
STUDY OF THE PROPERTIES OF ULTRAPURE NICKEL, by G. W. Hees, L. Castleman, and G. H. Morrison. Final rept. for 1 Oct-31 Dec 59, on Contract AF 19(604)5213. 30 Jan 60, 30p. 11 refs. TR59-104-205-704.3; AFCRC-TR-60-144.
Order from LC mi$2.70, ph$4.80 PB 150 280

Principal reliance is being placed on zone refining for the metallurgical preparation of the ultrapure nickel required for the program. A zone melting apparatus has been designed and is under construction. Pending delivery of the apparatus, a number of preliminary experiments have been undertaken to determine the feasibility of reducing the impurity level of the nickel prior to melting, and to altering the distribution coefficients of the impurities during melting. A detailed investigation has been made of solvent extraction from chloride solution as a method of removing trace iron from nickel and the method appears promising. Suitable cleaning procedures have been established and the necessary equipment and facilities are either available or on order. Steps are being taken to secure emission carborates of the necessary high purity. The charcoal absorption trap, while cumbersome to process, functions satisfactorily as a booster pump. The use of thermal titanium devices is under investigation. A temperature servo has been designed and is being constructed. (Author) (See also PB 144 972).

Structural Metallurgy and Corrosion

Aeronautical Materials [Lab] Naval [Air Material Center] Philadelphia, Pa.
ENDURANCE TESTS OF METALS; EFFECT OF CHROMIUM PLATING, by F. S. Williams. 28 July 42, 52p. 1 ref. Rept. no. AML(M)-595.
Order from LC mi$3.60, ph$9.30 PB 150 877

This report released for sale to the public 2 Nov 60.

Applied Mechanics Lab., Mass. Inst. of Tech., Cambridge.
DETECTION OF FATIGUE DAMAGE WITH RAYLEIGH WAVES, by Pierre J. Brosens, Nader A. G. Hakimi, and Ghassan R. Khabbaz. Rept. on Contract AF 33(616)6469. Aug 60, 57p. 28 refs. ARL Technical rept. 60-307.
Order from OTS $1.50 PB 171 099

Some aspects of the fatigue process in metals are presented which indicate that the detection of fatigue damage by ultrasonic means must be based on concentration of ultrasonic energy at the surface of the examined metal. Rayleigh waves appear to be those of most interest. They offer the possibility of detecting both fatigue damage prior to crack formation and the fatigue cracks present after crack formation. These ultrasonic waves are, therefore, studied theoretically and experimentally. In the experiments, only low frequency waves (2 megacycles) were used hence crack detection was achieved but detection of fatigue damage prior to crack formation was not. (Author)

Curtiss-Wright Corp., Caldwell, N. J.
SOME QUANTITATIVE ASPECTS OF FATIGUE OF MATERIALS, by Harold N. Cummings. Rept. for May 59-Apr 60 on Materials Applications, Contract AF 33(616)6552. July 60, 292p. 85 refs. WADD Technical rept. 60-42.
Order from OTS $4.00 PB 171 084

In this report are given not only the fatigue properties of many structural materials but also the "static" properties and such other supplementary information as was given in the references consulted. The data are in general from room temperature tests, but a few data are given on tests at higher temperatures. The data are presented in tables and on curves, supplemented by brief discussions in the text. (Author) (See also PB 161 145)

Institute for the Study of Metals, U. of Chicago, Ill.
CRYSTAL DISTORTION IN MAGNETIC COMPOUNDS, by Junjiro Kanamori. Technical rept. no. 2 on Contract Nonr-2121(13). Nov 59, 39p. 21 refs.
Order from LC mi$3.00, ph$6.30 PB 150 468

The crystal distortion which arises from the Jahn-Teller effect is discussed in several examples. In the case of compounds containing Cu^{2+} or Mn^{3+} at octahedral sites, the lowest orbital level of these ions is doubly degenerate in the undistorted structure, and there is no spin-orbit coupling in this level. It is shown that, introducing a fictitious spin to specify the degenerate orbital states, we can discuss the problem by analogy with the magnetic problems. The "ferromagnetic" and "antiferromagnetic" distortions are discussed in detail. The transition from the distorted to the undistorted structure is of the first kind for the former and of the second kind for the latter. Higher approximations are discussed briefly. In compounds like FeO, CoO and $CuCr_2O_4$, the lowest orbital level is triply degenerate, and the spin-orbit coupling is present in this level. In this case the distortion is dependent on the magnitude of the spin-orbit coupling relative to the strength of the Jahn-Teller effect term. The distortion at absolute zero temperature and its temperature dependence are discussed. (Author).

Institute for the Study of Metals, U. of Chicago, Ill.
MAGNETIC TRANSITIONS AT LOW TEMPERATURES, by J. W. Stout. Technical rept. no. 1 on Contract Nonr-2121(13). Nov 59, 20p. 31 refs.
Order from LC mi$2.40, ph$3.30 PB 150 467

Some examples of magnetic transitions in salts of divalent ions of manganese, iron, cobalt and nickel are discussed.

Manufacturing Labs., Inc., Cambridge, Mass.
MARTENETRON MATERIALS FOR USE IN BINARY RESISTANCE DEVICES, by Paul J. Fopiano. Rept. on Electronic Concepts of Information Handling, Contract AF 33(616)6414. Jan 60, 48p. 11 refs. WADD Technical rept. 60-273.
Order from OTS $1.25 PB 171 066

Certain metallic systems which exhibit a computer-type hysteresis loop, wherein a discontinuous change in resistance occurs at different temperatures depending on whether the temperature is being increased or decreased, are referred to as martenetron materials. The present investigation is concerned with the practicability of employing such materials in nonlinear resistance devices. The type of solid-state transformation in metallic systems upon which this device is based is known as a martensitic or diffusionless reaction. The selection of a wide range of potential martenetron materials with martensitic reactions has been carried out by surveying the literature. From this list, those systems felt to be of particular interest were investigated. In at least one system (iron-nickel), several compositions have been studied in considerable detail to correlate the effect of composition on the martensitic reaction. In each system, the resistance change, the critical temperature range, and the hysteresis effects (if any) have been determined. With typical high and low temperature materials, the stability after repeated cycling has been measured and metallurgical observations such as microhardness and metallography have been made. The effect of quenching media on switching rate, the heat requirements, and some possible methods of packaging have been investigated. (Author)

Massachusetts Inst. of Tech., Cambridge.
EXPERIMENTAL EVIDENCE FOR MARTENSITIC EMBRYOS, by M. H. Richman (Doctoral thesis), M. Cohen, and H. G. F. Wilsdorf (Franklin Inst. Labs.). Technical rept. no. 3 on Contract Nonr-1841(35) and rept. on Contract N5ori-78, Task XIV. 2 Nov 59, 6p. 7 refs.
Order from LC mi$1.80, ph$1.80 PB 150 850

Massachusetts Inst. of Tech., Cambridge.
THE TRANSFORMATION CHARACTERISTICS OF A BETA-PHASE TITANIUM ALLOY, by R. A. Rawe, J. M. Dupouy, and M. B. Bever. Technical rept. no. 3 on Physical Metallurgy of Titanium Alloys, Contract Nonr-1841(02). 20 Nov 59, 21p. 8 refs. DSR-7433; AD-229 740.
Order from LC mi$2.70, ph$4.80 PB 150 855

The transformation behavior of a titanium alloy containing 11% chromium, 13% vanadium and 4% aluminum has been investigated by hardness measurements, x-ray diffraction and metallography. The solution treated alloy consisted entirely of beta phase. Aging at temperatures between 700° and 1150°F increased the hardness; the rates of hardening suggested that beta decomposed by different modes upon aging above 1050°F and below 900°F and by a combination of these modes between these temperatures. X-ray diffraction analysis indicated that in the upper-temperature range the reactions $\beta \rightarrow \beta_r + \alpha \rightarrow \beta_u + \alpha + TiCr_2$ occurred, while in the low-temperature range, the transition phase omega appeared and the reactions were $\beta \rightarrow \beta_r + \omega \rightarrow \beta_\mu + \alpha$. Two modes of decomposition were also suggested by the microstructures. A TTT diagram is proposed on the basis of these results. The hardening is attributed to the precipitation of omega and alpha and to solid solution hardening of the remaining beta. An increase in solution time did not change the hardness of the solution treated specimens but decreased the rate of subsequent hardening. Cold working of solution treated specimens accelerated hardening and raised the hardness level attained. (Author) (See also PB 144 956)

Michigan U. Coll. of Engineering, Ann Arbor.
THE EFFECT OF SURFACE TENSION OF A LIQUID METAL ENVIRONMENT ON THE FRACTURE STRENGTH OF SOLID METALS, by D. A. Kraai, S. Floreen and others. Technical rept. on Contract AF 49(638)422. July 60, 301p. 8 refs. 2782-1-F; AFOSR-TR-60-116.
Order from LC mi$11.10, ph$47.10 PB 150 637

This report is divided into three sections. Each section covers a specific aspect of the relationship of surface and environments and their effects on the mechanical properties of solids: (1) effects of some liquid metal environments on the fracture of copper. (2) the effect of strain on the surface energy of solids. (3) the effect of tensile stress on dihedral angles in leaded copper.

Minnesota U., Minneapolis.
FATIGUE AND STRESS RUPTURE PROPERTIES OF INCONEL 713C, V-57C AND TITANIUM ALLOYS 7Al-3Mo-Ti AND MST 821 (8Al-2Cb-Ta-Ti), by A. E. Cers and A. A. Blatherwick. Rept. for Jan 58-Dec 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(606)6828. July 60, 92p. 17 refs. WADD Technical rept. 60-426.
Order from OTS $2.25 PB 171 064

Fatigue, rupture and creep data at various temperatures obtained at various alternating and mean stress combinations are presented for the alloys Inconel 713C, V-57C (modified Super A-286), 7Al-3Mo-Ti and MST 821 (8Al-2Cb-1Ta-Ti). The tests were performed on unnotched specimens and for Inconel 713C also on notched specimens having a theoretical stress concentration factor of 2.9. The data are presented as S-N curves and stress-range diagrams to show the effect of temperature, ratio of alternating-to-mean stress, stress magnitude and specimen notch on the fatigue and rupture properties. (Author)

Naval Research Lab., Washington, D. C.
CORROSION OF METALS IN TROPICAL ENVIRONMENTS. PART 5: STAINLESS STEELS, by B. W. Forgeson, C. R. Southwell, and A. L. Alexander. Interim rept. 19 Sep 60, 24p. 15 refs. NRL rept. 5517.
Order from OTS $0.75 PB 161 749

Over a period of eight years, six stainless steels have been exposed to underwater and atmospheric environments in the Panama Canal Zone. Stainless steels are severely pitted during sea water immersion; the mean tide immersion produced one-fourth to one-tenth the pitting of continuous immersion, and the metals were practically unattacked when submerged in fresh water. Greater pitting attack in tropical than temperate seas may be the result of heavy marine fouling. The type and extent of pitting attack of stainless steels is compared with phosphor bronze and several structural steels. Stainless steel is not recommended for sea water service where perforation of structure is a consideration; it was inferior to phosphor bronze and to the structural steels. In fresh water, stainless steels are superior to ordinary steels and equal to phosphor bronze which is noncorrosive in this environment. Tropical atmospheres appear to be no more corrosive to stainless steel than temperate climates; the marine effects are slightly greater than the inland. However, precautions should be taken to eliminate cracks where passivity-destroying agents could accelerate pitting attack. (Author)

Nuclear Metals, Inc., Concord, Mass.
BERYLLIUM RESEARCH AND DEVELOPMENT IN THE AREA OF COMPOSITE MATERIALS, by Jacob Greenspan, Gerald A. Henrikson, and Albert R. Kaufmann. Rept. for 15 June 58-14 June 59 on Metallic Materials, Contract AF 33(616)5912. July 60, 121p. 33 refs. [NMI-9404] WADD Technical rept. 60-32.
Order from OTS $2.75 PB 171 083

Ductility of some beryllium composite materials is compared to the ductility of beryllium itself. Bend ductility in sheet beryllium as a function of sample width and thickness revealed that grain orientation also played a part. Strip composites consisting of alternate strips of beryllium and aluminum or silver filler metal were investigated. Clad composites did not institute unusual changes in the composites' ductility. However, cladding appeared significant as a "failwafe" and surface-protection medium. Beryllium may be cladded by rolling or extrusion when a thin silver interlayer is present between core and cladding. Silver or aluminum coating did not change unusually the tensile strength or ductility of beryllium composites. Methods for polishing beryllium surfaces are described. (Author).

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Bureau of Naval Personnel, Washington, D. C.
BASIC NUCLEAR PHYSICS. 1958, 270p. NAVPERS 10786.
Order from LC mi$11. 10, ph$41. 10 PB 152 233

This report released for sale to the public 15 Nov 60.

This publication, Principles of Nuclear Physics, has been issued as a source of background information for students attending the nuclear courses of the Special Weapons Training Group, AFSWP. Students whose training in physics is incomplete, or who lack an understanding of the unclassified aspects of nuclear phenomena as revealed by modern research, will find the information in this publication of value in comprehending course material.

[Quantum, Inc., Wallingford, Conn.]
THE FORMATION OF NEW POLYMERS USING IONIZING RADIATION. Quarterly technical rept. no. 1, 12 Sep-12 Dec 58, on Contract DA 44-009-eng-3723. [1959] 11p. AD-226 148.
Order from LC mi$2.40, ph$3.30 PB 152 648

This report released for sale to the public 7 Nov 60.

The objectives are: (1) the formation of new and structurally useful polymeric materials, and (2) the formation of liquid or resinous coating materials.

Quantum, Inc., Wallingford, Conn.
THE FORMATION OF NEW POLYMERS USING IONIZING RADIATION, by R. F. Horan. Quarterly technical rept. no. 2, 12 Dec 58-12 Mar 59, on Contract DA 44-009-eng-3723. [1959] 37p. 17 refs.
Order from LC mi$3.00, ph$6.30 PB 152 649

This report released for sale to the public 7 Nov 60.

Radiation induced polymerization involves only the pure starting compounds and should therefore produce materials of intrinsically higher thermal characteristics and dielectric strength properties. Eight of the thirty-five reactions reported to date have produced polymers of some promise. Melting points of these polymers are generally on the order of 300°C. Proposed structures for these products involve the highly stable P-N cyclic structures as in the triallycyanurate - phosphonitrillic chloride copolymer; phenyl-Sn-C- chains as in polymers formed with triallylcyanurate-diphenyldichlorostannane. Analysis of reaction mechanisms has been arrived at both through a study of reports in the literature concerning radiation effects on analogous chemical compound and through a correlation of the known fundamental aspects of radiation interaction with matter. Infra-red absorption spectra of control and irradiated samples are supplied by ERDL. Data from these curves has supported the proposed reaction mechanisms. (Author)
(See also PB 152 648)

Cosmic Rays

Air Force Missile Development Center, Holloman AFB, N. Mex.
AIRBORNE DETECTION AND ANALYSIS OF PRIMARY COSMIC PARTICLES WITH A SCINTILLATION DEVICE, by dePaul J. Corkhill and Rudolf A. Hoffman. July 60, 17p. AFMDC-TN-60-12.
Order from LC mi$2.40, ph$3.30 PB 150 371

This paper presents data derived from telemetered information from a primary cosmic particle detecting device. The data are preliminary in nature in that comparison between the cosmic particle spectrum (as shown by the mechanical detector) has not as yet been made with similar information provided by nuclear emulsions exposed to regions of primary cosmic particles simultaneously with the mechanical device. (Author).

Iowa State U., Iowa City.
OBSERVATIONS PERTAINING TO COSMIC RAY ORIGIN, by Kinsey A. Anderson. [1959] 19p. 14 refs. Rept. SUI-59-23.
Order from LC mi$2.40, ph$3.30 PB 150 518

Assuming the other stars in the galaxy supply energetic particles in the same manner as the sun the high energy cosmic radiation might be maintained if the Fermi acceleration process provided a high rate of energy gain per gas cloud collision. However calculations show that a high rate of energy gain does not lead to the flat energy spectrum exhibited by the galactic cosmic rays. Also, the absence of fast solar-accelerated helium indicates that if the sun is to be a typical injector of cosmic radiation the energy gain in the galaxy would have to be rapid, a requirement again inconsistent with the spectral shape calculation. It therefore appears that using the sun as a model cosmic ray injector together with the Fermi acceleration process is not a suitable means of producing the galactic cosmic radiation. (Author).

Elementary Particles

Army Chemical [Research and Development] Labs., Army Chemical Center, Md.
THE FEASIBILITY OF USING A REACTOR AS A NUCLEAR-WEAPONS SIMULATOR FOR SOIL-ACTIVATION STUDIES, by John H. McNeilly and Edward F. Wilsey. Rept. for Apr 58 on Protection Against Radiological Hazards. June 60, 28p. 10 refs. Radiological Lab. Technical rept. CWLR 2380; AD-238 961.
Order from LC mi$2.70, ph$4.80 PB 152 000

The experiment described uses a nuclear reactor as a neutron source to simulate a nuclear weapon for studying the residual gamma activity induced in soils. The results obtained are then compared with results obtained from a nuclear detonation. The reactor-irradiation and nuclear-detonation data are in good agreement for sodium; however, the results with manganese are between 35% and 50% higher for the reactor irradiation than for the nuclear detonation. The behavior of the thermal-

neutron flux with relation to depth was very similar at depths greater than 15 cm. The nuclear-detonation neutron-flux data showed a peaking of the thermal flux at about 8 cm, but these peaks were not seen in the nuclear reactor data. This was explained by the neutron-spectrum differences and the lack of optimum experimental conditions because of a rainstorm during irradiation by the reactor. Although the feasibility of using a reactor in place of a nuclear detonation for studying neutron-induced activities in soil looks promising it cannot be definitely established by the results of this study. (Author).

Durham U. (Gt. Brit.).
VARIATIONS OF THE SEA LEVEL MUON FLUX, by P. V. O'Connor and A. W. Wolfendale. Technical note no. 1 on Contract AF 61(052)27. 26 Jan 60, 24p. 5 refs. AFCRC TN-60-283.
Order from LC mi$2.70, ph$4.80 PB 150 937

The characteristics are described of a cosmic ray spectrograph which uses a solid iron magnet with Geiger counters as detecting elements. The instrument is being used to study the variations of the μ-meson flux at sea level, with direction and time, as a function of momentum. Preliminary results are reported of the measurement of the pressure coefficient of the μ-meson flux for three bands of momenta having median values 2.9 GeV/c, 4.5 GeV/c and 8.6 GeV/c. Using a simple one-term regression formula the corresponding pressure coefficients are 0.25% mb^{-1}, 0.15% mb^{-1} and 0.11% mb^{-1}. These values bear a constant ratio to the expected coefficients, as would be expected from an analysis based on the known mechanism of the propagation of cosmic rays and the properties of the atmosphere. (Author).

Maryland U., College Park.
STRANGE PARTICLE DECAYS AND THE NATURE OF WEAK INTERACTIONS. VOLUME I, by Jogesh C. Pati. Rept. on Contract AF 49(638)24p. Sep 60, 152p. 146 refs. Physics Dept. Technical rept. no. 193; [AFOSR] TN-60-1051a.
Order from LC mi$7.50, ph$24.30 PB 152 058-1

Chap. I. Introduction: Nature of interactions of elementary particles; experimental foundation of universal four fermion interactions between nucleons and leptons; theoretical frame-work of universal four fermion interaction; the strange particles; general features of strange particle decays.
Chap. II. The decay of the Λ-hyperon: Scheme of interaction; preliminaries on Λ-decay; previous work (The OMS-Analysis) and success; needs for new look; a new class of diagrams; evaluation of the matrix element of the new diagram
Chap. III. The decay of the K-meson: The leptonic decay modes of K-meson; the asymmetry in the energy distribution of $K^+ \rightarrow \pi^+ + \pi^- + \pi^+$-decay.

Maryland U., College Park.
STRANGE PARTICLE DECAYS AND THE NATURE OF WEAK INTERACTIONS. VOLUME II, by Jogesh C. Pati. Rept. on Contract AF 49(638)24. Sep 60, 143p. 43 refs. Physics Dept. Technical rept. no. 193; [AFOSR] TN-60-1051b.
Order from LC mi$7.20, ph$22.80 PB 152 058-2

Chap. IV. The possible existence of an intermediate vector boson: Speculation; general effects of the non-locality in four fermion interactions; absence of $\mu \rightarrow e + \gamma$-decay; the assignment of Lepton Numbers and the nature of the neutrino; effects of non-locality on the energy spectra in K_{e3} ($K_{\mu 3}$)-decays; effects of non-locality on the decay of the Λ-hyperon
Appendix: Notations; The angular distribution of pions and longitudinal polarization of nucleon in the decay of Λ-hyperon; Matrix elements of various K-meson decay modes; Decay rates of various K-meson-modes; Energy spectra in $K_{\mu 3}$ and K_{e3}-decays for local and non local four fermion interaction; Matrix element of the single neutron-intermediate state diagram for $\Lambda \rightarrow N + \pi$-decay with intermediate vector boson. (See also PB 152 058-1)

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
THE NEUTRON PRODUCING MECHANISM IN TRANSVERSE PINCHES, by V. Josephson, M. H. Dazey, and R. F. Wuerker. Rept. on Contract AF 04(647)309. 9 Aug 60, 14p. 12 refs. STL/TR-60-0000-19258.
Order from LC mi$2.40, ph$3.30 PB 150 776

Experiments performed on a transverse pinch assembly show that the presence of a longitudinal magnetic field inside of a conducting plasma and in the reverse direction to that of the external pinching field results in the generation of the m = 0 (sausage) instability mechanism. This instability mechanism can generate high electrical fields which will accelerate deuterons to energies sufficient for neutron production in deuterium plasmas. Subsequent to the blow-up of the instability, the plasma-field configuration is such that the accelerated deuterons can continue to circulate in stable orbits until lost by neutron producing collisions or by diffusion out of the ends of the geometry. (Author)

Uppsala U. (Sweden).
ANTIPROTON ANNIHILATIONS IN COMPLEX NUCLEI, by A. G. Ekspong, A. Frisk and others. Technical note no. 1 on Contract AF 61(052)13, phase G. [1960] 83p. 44 refs. AFOSR-[TR]-60-937.
Order from LC mi$4.80, ph$13.80 PB 150 351

356 antiproton annihilations in nuclear emulsion have been investigated. The average pion multiplicity and total energy in the primary process were found to be: at rest $\langle N'_\pi \rangle = 4.68 \pm 0.12$, $\langle E'_\pi \rangle = 391 \pm 10$ MeV in flight $\langle N'_\pi \rangle = 5.11 \pm 0.12$, $\langle E'_\pi \rangle = 390 \pm 9$ MeV at $\langle T_p \rangle = 166$ MeV. The results for $K\bar{K}$-production are: percentage at $K\bar{K}$ - pairs $\langle N'_{K\bar{K}} \rangle = 3 \pm 2\%$ average energy $\langle E_{K\bar{K}} \rangle = 33 \pm 22$ MeV/star.

Virginia U., Charlottesville, Va.
RESEARCH STUDIES WITH A 1-MEV VAN DE GRAAFF MACHINE, by Frank L. Hereford. Annual rept. on Contracts AT (40-1)-1754 and DA 36-034-ORD-2046. June 60, 16p. 7 refs. OOR rept. 1510.8-P; AD-239 923.
Order from LC mi$2.40, ph$3.30 PB 150 406

Instruments and Installations

Army Chemical Research and Development Labs., Army Chemical Center, Md.
A SURVEY OF SOLID-STATE GAMMA/NEUTRON DETECTION SYSTEMS, by Russell Gminder, John W. Kinch and others. July 60, 64p. 197 refs. CRDLR 3020; AD-241 399.
Order from OTS $1.75 PB 171 124

This analysis, which is based on an extensive literature search and on personal contacts with some of the leading researchers in solid-state radiation detection, presents the major advantages and limitations of many solid-state detection systems. Some recently proposed and partially studied systems are also discussed. The systems were classified according to the radiation-induced effect utilized for measurement. (Author)

Kellogg Radiation Lab., Calif. Inst. of Tech., Pasadena.
PRESENT STATUS OF SEMICONDUCTOR PARTICLE COUNTERS, by C. A. Barnes. Technical rept. on Contract Nonr-220(18). 23 Nov 59, 8p. 9 refs. AD-229 706.
Order from LC mi$1.80, ph$1.80 PB 150 473

Naval Radiological Defense Lab., San Francisco, Calif.
A STUDY OF THE REPRODUCIBILITY OF IONIZATION READINGS OBTAINED WITH LANDSVERK MODEL L-65 200-mr POCKET CHAMBERS, by B. W. Shumway, H. H. Hechter, and W. G. Miller. 4 Jan 60, 18p. 5 refs. Research and Development technical rept. USNRDL-TR-399; AD-233 424.
Order from LC mi$2.40, ph$3.30 PB 152 677

This report released for sale to the public 16 Nov 60.

A study was made of the reproducibility of ionization readings obtained with Landsverk 200-mr chambers used in conjunction with modified Model L-62 charger-readers. The errors considered were the differences between radiation trials, between 2 charger-readers, between chambers, and between 2 methods of reading. These were measured at levels of exposure of 33, 100, and 167 mr. Estimates of the errors associated with the degree of exposure indicated that the variance of the readings was proportional to the scale reading. It was observed that some chambers did not maintain a given calibration though others were excellent. The modified charger-readers were found to be interchangeable, and readings could be reproduced at full scale with an error of about 2-1/2%. A systematic error was observed when the meter of the charger-reader was set at zero prior to introducing a chamber to be read. A method of reading in which an offset from zero was made prior to introducing a chamber resulted in nearly eliminating the error. There was a variation in the readings obtained with different radiation trials. (Author)

Texas Nuclear Corp., Austin.
A PROTON-RECOIL ORGANIC SCINTILLATION SPECTROMETER AND INVESTIGATION INTO A VARIABLE THRESHOLD SPARK COUNTER, by John B. Ashe, William E. Tucker and others. Rept. for 18 Feb 59-17 May 60 on The Chemistry and Physics of Materials, Contract AF 33(616)6362. July 60, 35p. 31 refs. WADD Technical rept. 60-293.
Order from OTS $1.00 PB 171 120

A scintillation detector is described which has the ability to differentiate between neutrons and gamma rays by means of the different decay times of recoil proton and Compton electron scintillations. This detector has been incorporated into a neutron spectrometer which is highly insensitive to gamma rays over a detectable neutron energy region of approximately 0.8 Mev to greater than 17 Mev. Data obtained with the spectrometer are presented. In addition to the scintillation detector, investigations into the feasibility of using a spark counter as an energy sensitive neutron detector are also described. The results of these investigations are discussed and representative data are presented. (Author)

Nuclear Engineering and Power

Ballistic Research Labs., Aberdeen Proving Ground, Md.
BLAST EFFECTS TESTS OF A ONE-QUARTER SCALE MODEL OF THE AIR FORCE NUCLEAR ENGINEERING TEST REACTOR, by Wilfred E. Baker and James D. Patterson, II. Rept. on Contracts AF 33(616)3471 and AF 33(616)56-83. Mar 57, 187p. 1 ref. Rept. no. 1011; AD-129 167.
Order from LC mi$8.40, ph$28.80 PB 148 647

This report released for sale to the public 17 Nov 60.

This report presents the results of a series of ten simulated nuclear power excursions conducted within a one-quarter scale model of the Air Force Nuclear Engineering Test Reactor. The objective of the tests was to simulate, as closely as possible, large nuclear power excursions of the potential predicted by the "Borax" test data and to experimentally evaluate the effects of the resulting blasts on the reactor structure and safety shell. Explosives and propellants were used to simulate the power excursions. Measurements were made of the time histories of pressures, strains, displacements and accelerations at various locations within the model. It is concluded that the reactor design will, with minor modifications, safely contain an explosively-released energy of 1000 megawatt-seconds. This is approximately three times the maximum energy release in the maximum credible power excursion for the AF NETF reactor. The accuracy of simulation of an excursion by explosives and propellants and the applicability and limitations of scaling of blast loading and structural response are discussed. (Author)

Convair, Fort Worth, Tex.
REACTOR POWER CALCULATOR, by J. R. Gardner. Rept. on Contract AF 33(600)32054. 30 Apr 58, 24p. NARF-58-18T; MR-N-136; AD-159 902.
Order from LC mi$2.70, ph$4.80 PB 152 358

This report released for sale to the public 28 Oct 60.

An electromechanical power calculator was developed for use with the aircraft shield test reactor and the ground test reactor. The computer solves the equation, $P = Q\Delta T$, by means of a flow rate amplifier which supplies a voltage that is linear with flow rate, and a null balance servo system which produces a potentiometer shaft position that is linear with the temperature differential existing between the coolant water flowing into and out of the reactor. The computer contains its own power supply and reference supplies as well as a self-contained low-flow alarm system. One version uses 60 cycle power, while another was constructed for 400 cycle power. (Author)

Convair, Fort Worth, Tex.
REMOTE INSPECTION OF AIRCRAFT WITH TELEVISION, by W. A. Baird. Rept. on Contract AF 33(600)32054. 12 May 58, 51p. 9 refs. NARF-58-19T; MR-N-209.
Order from LC mi$3.60, ph$9.30 PB 152 359

This report released for sale to the public 28 Oct 60.

A preliminary experiment was performed in the use of closed circuit black and white television to inspect aircraft. Television equipment was used to evaluate the effect of lighting, camera position, and lenses on the inspection problem. An industrial closed circuit television system was set up at a B-47 airplane. The time required and the accuracies obtained were compared between normal (direct visual) inspections of certain items and remote inspections made with television equipment. The effectiveness of television inspection was studied in a series of experimental set-ups. For each set-up, the interrelationships of the factors which influence picture quality were studied. A detail analysis is presented of optical phenomena and television equipment characteristics. Subjects treated include depth of field, resolution, video bandwidth, lens systems, and lighting. The experiment shows that remote inspection of aircraft with television is feasible. Results indicate that off-the-shelf type television components can be obtained which are satisfactory for this application. Only such items as the lighting equipment and the camera boom and dolly will have to be of special design. (Author)

Nuclear Reactions

Faculté des Sciences, Orsay (France).
RELATIVISTIC DEUTERON WAVE FUNCTION. II, by M. Gourdin and J. Tran Thanh Van. Technical note no. 19 on Contract AF 61(052)173. [1960] 22p. 4 refs. AFOSR-TN-60-917.
Order from LC mi$2.70, ph$4.80 PB 150 349

Carrying on research on the deuteron relativistic wave function, Bethe and Salpeter's relativistic wave equation has been applied to the bound system of two particles with spin 1/2. After some very slight approximations, the solution of the infinite system of coupled integral equations enables one to find the explicit structure of the wave matrices corresponding to the S and D states. The percentage of D state obtained is in good agreement with the experimental result. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
A HARTREE SELF CONSISTENT METHOD FOR THE SCATTERING OF POSITRONS BY HYDROGEN ATOMS, Richard S. Ruffine. Rept. on Contracts AF 19(604)4555 and DA 30-069-ORD-2581. Apr 60, 69p. 14 refs. Research rept. no. CX-48; AFCRC TN-60-441.
Order from LC mi$3.90, ph$10.80 PB 150 944

We have developed a method for generalizing the Hartree self consistent scheme used for atomic structure problems so that it may be used for problems of the scattering of electrons or positrons by atomic systems. This method has been used to calculate the scattering of positrons by hydrogen atoms. For this problem, we have three coupled differential equations. The effective interaction is made up of a sum of induced multipoles. We have confined ourselves to the dipole interaction and then integrated the system of equations for s-wave scattering self consistently on a high speed computing machine. The system of equations reduces to the adiabatic approximation if we assume that there is negligible penetration of the atom by the incident particle. The results of the calculation show that there is a large attractive potential between the positron and the atom for very low incident energies, in agreement with the recent results of Spruch and Rosenberg. In fact our results lie somewhat between the static approximation and the lower bounds published by these last authors. It is encouraging that the correlations responsible for the attractive potential do show up. Presumably if spherical distortion and higher induced multipoles of the atoms were included the results would improve. The method is applicable in principle to the problem of the scattering of electrons by hydrogen and by more complicated atoms. (Author).

Pittsburgh U., Pa.
ELECTRON CAPTURE AND LOSS BY HYDROGEN ATOMS IN MOLECULAR HYDROGEN, by R. Curran (Doctoral thesis) and T. M. Donahue. Technical rept. no. 9 on Captive-loss and Ionization Cross-Sections of Ions and Neutral Particles, Contract Nonr-624(06). Nov 59, 20p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 150 523

Measurements of the single electron capture and loss cross sections for atomic hydrogen in molecular hydrogen are reported for atoms of energies 4 to 35 Kev. Peaks in the loss cross section are found which appear to be associated with the formation of negative ions in the target gas. (Author)

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.
AN ANALYSIS OF (d, t) PICK-UP REACTIONS, by Amélia Império Hamburger (Master's thesis) [and] FINITE RANGE CORRECTION IN DISTORTED WAVES CALCULATIONS, by Norman Austern. Technical rept. no. 2 on Precision Scattering of Nuclear Particles, Contract Nonr-624(10). Nov 59, 52p. 26 refs. AD-230 172.
Order from LC mi$3.60, ph$9.30 PB 150 516

A comparison is made between (p, d) [or (d, p)] and (d, t) pick-up reactions involving transitions between the same nuclear levels. Cases are studied for nuclei from A=6 to 25 (also A=117), for orbital angular momentum transfer l=0, 1 and 2, and for incident energies of the order of 15 Mev. It is found that if the differential cross sections of the corresponding (d, p) and (d, t) reactions are plotted as functions of momentum transfer the curves differ by a factor independent of angle. Because of the proportionality between the curves in the forward direction, it is possible to obtain an expression for extracting the stripping reduced width of (d, t) reactions. This reduced width corresponds to the reduced width of the same transition when studied by a (d, p) process. No emphasis is placed on the interpretation of the results in terms of the structure of the trition. A general and unified approach for estimating finite range corrections in reactions such as (n, n'), (n, p), (d, p) is also presented, and the use of distorted wave functions enhances these corrections. The method is suitable for incorporation into machine calculations of these reactions. (Author)

Radioactivity

Army Engineer Research and Development Labs., Fort Belvoir, Va.
SOLUBILITY CHARACTERISTICS OF RADIOACTIVE BOMB DEBRIS IN WATER AND EVALUATION OF SELECTED DECONTAMINATION PROCEDURES, by Harry N. Lowe, Jr., Don C. Lindsten and others. 12 Feb 59, 85p. 2 refs. Technical rept. 1569-TR; AD-212 440.
Order from LC mi$4.80, ph$13.80 PB 152 650

This report released for sale to the public 7 Nov 60.

The more important results of these experiments are summarized as follows: (a) The radioactive debris resulting from a nuclear detonation was only sparingly soluble in water. (b) The solubility of the radioactive debris increased as the pH of the solvent was lowered. (c) Filtration through dense filter pads or through bonded ceramic elements effectively removed suspended radioactive debris from water. Such filtration followed by demineralization with a column of mixed bed ion exchange resins removed both suspended and dissolved contaminants. (d) Coagulation followed by filtration was effective in removing suspended contaminants from water but was relatively ineffective in removing the dissolved components of the radioactive debris. (e) Lime and lime-soda softening were relatively ineffective in removing the dissolved components of radioactive debris from water. (f) Clay was not effective in removing the dissolved contaminants from water although earlier research had indicated that significant removals of many radioisotopes can be thus achieved. (g) Coagulation followed by filtration followed by demineralization by ion exchange resins removed all of the contaminants, suspended and dissolved components alike. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE USE OF PLASTIC SHIELDS TO REDUCE PERMANENT NUCLEAR RADIATION DAMAGE, by Edwin T. Hunter. 15 June 60, 18p. 5 refs. USASRDL Technical rept. 2123.
Order from LC mi$2.40, ph$3.30 PB 150 687

Permanent alteration in DC electrical characteristics of germanium, homogeneous base, pnp, power transistors was determined as a function of the thickness of epoxy-type shielding material surrounding the device. Exposures were made on the Godiva reactor at Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Results indicate that most of the permanent damage is caused by fast neutrons, with a smaller part of the damage being caused by some other component of the radiation, and that the epoxy shields thermalize many of the fast neutrons, thereby reducing the permanent damage suffered by the transistors. The subsequent increase in thermal neutrons and gamma-rays inside the shields will probably have an effect on the transient alterations in electrical characteristics of the devices, but this facet of the investigation was not studied at this time. (Author)

Bureau of Yards and Docks, Washington, D. C.
RADIOACTIVITY IN WATER SUPPLY AND WASTE WATER SYSTEMS: PEACETIME DETECTION AND CONTROL. June 60, 88p. 68 refs. Technical pub. NAVDOCKS TP-Te-6.
Order from OTS $2.25 PB 171 091

This publication presents the latest information on the detection, handling, and disposal of such peacetime radioactive contamination in water supplies and wastes. These data have been prepared for the guidance of management personnel who are concerned with the design, control, and operation of water supply and waste water systems where radioactivity is involved.

Convair, Fort Worth, Tex.
FISSION PRODUCTS FIELD RELEASE TEST. 1. Rept. on Contract AF 33(600)32054. Sep 59, 477p. 17 refs. NARF-59-32T; FZK-9-140; AFSWC TR-59-44; AD-228 267.
Order from LC mi$11.10, ph$72.60 PB 152 806

This report released for sale to the public 17 Nov 60.

A test was performed to check and resolve uncertainties in the currently used methods of safety analysis for nuclear aircraft. The test was made to evaluate release percentages, airborne radioactivity, and diffusion and deposition characteristics of fission products from melted aircraft reactor fuel elements. A corollary objective was to determine the retention and distribution of the released fission products in animals located within the release network. A highly instrumented fan-shaped grid having 7 concentric arcs with

a maximum radius of about 5 miles was used to collect cloud diffusion, meteorological, radiological, radiobiological and radioactivity deposition data. Release percentages, size of aerosols, deposition velocities, external and internal dose, fluorescent tracer behavior, and atmospheric diffusion parameters were determined. (Author)

National Bureau of Standards, Washington, D. C.
SCATTERING OF COBALT-60 GAMMA RADIATION IN AIR DUCTS, Charles Eisenhauer. Oct 60, 25p. 9 refs. Technical note 74.
Order from OTS $0.75 PB 161 575

The exposure dose rates due to Cobalt-60 gamma radiation scattered in small air ducts in concerte has been measured for ducts with one and two right angle bends. The inside corner of a right angle bend has been found to be an important source of scattered radiation. Results are analyzed in terms of solid angle relationships and attempts are made to extrapolate experimental results to other duct configurations. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
COMPUTATION OF EARLY-TIME FISSION PRODUCT DOSE-RATE SPECTRA AND GAMMA-RAY AIR ATTENUATION, by C. F. Ksanda and E. Laumets. Rept. on Effects of Atomic Weapons. 14 Sep 59, 39p. 16 refs. Research and Development technical rept. USNRDL-TR-361; AD-232 225.
Order from LC mi$3.00, ph$6.30 PB 152 644

This report released for sale to the public 7 Nov 60.

On the basis of recent measurement of photon spectra for short-time irradiations of U^{235}, fission-product dose-rate spectra are computed for times from 1.7 to 1550 sec after fission. Air-attenuation curves that would result from point-isotropic sources having such spectral distributions are then computed. The fact that the attenuation curves are nearly straight lines when plotted against distance from the source on a semilogarithmic scale indicates that an effective attenuation coefficient, $\bar{\mu}$, can be used in computing the gamma-ray air attenuation. The attenuation is given by an expression of the form $F = \exp(-\bar{\mu}x)$, where the value $\bar{\mu}$ is an effective attenuation coefficient, varying with time after fission, that takes into account absorption and buildup of the gamma rays over the entire radiation spectrum. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
IDENTIFICATION OF MICRON-SIZED, INSOLUBLE-SOLIDS FALLOUT PARTICLES COLLECTED DURING OPERATION REDWING, by W. R. Schell. Rept. on Effects of Atomic Weapons. 24 Sep 59, 20p. 5 refs. Research and Development technical rept. USNRDL-TR-364; AD-229 280.
Order from LC mi$2.40, ph$3.30 PB 152 646

This report released for sale to the public 10 Nov 60.

Fallout from Redwing shots Flathead and Navajo, detonated on barges anchored in shallow water, is described. The insoluble solids formed by the vaporization and subsequent condensation of the barge, coral ballast, fission products, and evnironmental sea salts were analyzed through electron diffraction, electron microscopy, emission spectrography, photomicrography, and X-ray diffraction. These insoluble solids were found to consist primarily of spherical particles less than 1 μ in diameter and to be composed to compounds and elements consistent with the environmental materials. (Author)

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Aerospace Medical [Div.] Wright Air Development Div., Wright-Patterson AFB, Ohio.
GUIDE TO AIRCREW PERSONAL AND AIRCRAFT INSTALLED EQUIPMENT, by Paul F. Kiehl. Sep 60, 156p. WADD Technical note 60-230, supersedes WADC TN-58-259, Aug 58.
Order from OTS $3.00 PB 171 119

A catalog format has been used in this technical note to describe and illustrate both personal equipment for aircrews and the equipment installed in aircraft that is of special interest to aircrews. The document includes information on special high altitude and long range flight clothing, personal and aircraft-installed oxygen equipment, survival kits, life rafts and preservers, parachutes, in-flight feeding systems, survival food packets, and aircraft-installed food service equipment. Brief descriptions of 128 items are included along with photographs illustrating the items. (Author)

California U., Los Angeles.
PREDICTION OF THERMAL TOLERANCE WHEN USING AN MA-2 VENTILATING GARMENT WITH A MODIFIED MK-IV ANTI-EXPOSURE SUIT, by John W. McCutchan and John D. Isherwood. Rept. for June 58-Mar 59 on Human Thermal Tolerance, Contract AF 33(616)5402. June 59, 32p. 11 refs. WADC Technical rept. 59-326; AD-226 520.
Order from LC mi$3.00, ph$6.30 PB 152 299

This report released for sale to the public 25 Oct 60.

The physiological responses of human subjects have been investigated in the thermal environments ranging from 120° to 240°F while wearing the MA-2 ventilating garment, and MK-IV exposure suit, and other garments comprising 2.15 clo of thermal resistance. The ventilating garment was given air inputs ranging from 2 to 14 ft^3 per minute in volume, and from 50° to 90°F in temperature. The thermal responses of the subjects are shown graphically in terms of heat storage, heart rates, sweat rates, and composite indices of these variables. The results of these experiments have been prepared in terms of an equation which is presented graphically as a nomograph. This nomograph predicts the cooling power of the MA-2 ventilating garment and is to be used in conjunction with the tolerance chart available in the HIAD. The tolerance data, which were determined on steady exposures in a preheated chamber, are used to predict human tolerance for conditions where the air and wall temperatures are not constant. (Author)

Columbia U. School of Engineering, New York.
ORDERING AND DISPOSAL OF INVENTORY WITH FIFO OR LIFO ISSUING AND KNOWN DEMAND, by Arthur F. Veinott, Jr. Technical rept. no. 5 on Contract Nonr-266(55). 5 Dec 59, 98p. 18 refs.
AD-231 842.
Order from LC mi$5.40, ph$15.30 PB 152 124

Efficient ordering and disposal policies are studied when the utility of stock depends upon its age at issuing and where an issuing policy is specified. The assumption is made that the stock is issued on a last-in-first-out (LIFO) or a first-in-first-out (FIFO) basis. The problems considered are (1) find an optimal ordering policy when no disposal is allowed and where the issuing policy is given, and (2) find both an optimal ordering and an optimal disposal policy where the issuing policy is given. The demands are assumed to be known with certainty in both problems. The problem of inventory control may also be viewed as a problem in quality control because the methods of ordering and issuing affect the quality of product issued.

Engineering Div., Air Materiel Command, Wright-Patterson AFB, Ohio.
THE BIOPHYSICAL REQUIREMENTS FOR VENTILATED CLOTHING, by E. S. Fletcher, Samuel I. Rapaport, and John F. Hall. 5 May 48, 66p. 24 refs. Rept. no. 5702; ATI-23 309.
Order from LC mi$3.90, ph$10.80 PB 152 298

This report released for sale to the public 25 Oct 60.

The purposes of this report are to establish the principles for engineering development of ventilated clothing and define the ventilation requirements for a wide temperature range; to record new observations upon temperature regulation of the extremities and relate these findings to ventilated and electrically heated clothing. The following conclusions are reached: (1) Forced, internal ventilation of clothing offers a practical and economical means of thermal protection in hot environments, in environments which vary between hot and cold, and in environments which require impermeable (Personnel Supplies and Personal Equipment, 13 Jan 61) outer clothing, provided that an air supply hose may be attached to the wearer. (2) Ventilated clothing permits choice of protective and/or insulative garments on the basis of functional suitability alone, since no thermal stress is imposed on the wearer. (3) Orderly engineering development is feasible on the basis of the principles and requirements set forth herein. (4) The hands and feet require no artificial heating or cooling in the range between -30°F. and +180°F., if prolonged contact with good conductors is avoided. With ventilated clothing, it is better to err on the side of overheating, rather than of over-cooling the body to insure protection of the extremities at very high or low temperatures. (5) The power distribution of the present standard electrically heated clothing requires re-examination. (Author)

Naval Supply Research and Development Facility, Bayonne, N. J.
LABORATORY EVALUATION OF IMPERMEABLE PROTECTIVE CLOTHING, by Sidney A. Schwartz. Nov 59, 28p. 11 refs. Clothing and Textile Division rept. no. 45.
Order from LC mi$2.70, ph$4.80 PB 150 778

Two series of tests were conducted with impermeable protective clothing. The first was to determine the ambient temperature at which the heat load began to cause intolerable physiological stress. The second evaluated garments designed to reduce or relieve this stress. It was found, under test chamber conditions, that temperatures below 80°F caused little heat stress under moderate activity for two hours. Ambient temperatures from 80° to 90°F caused varying degrees of stress with the intolerable condition being reached at 90°F. Ambient humidity appeared to be of minor importance for those wearing impermeable garments. At 90°F temperature, filtered ventilation slits depending upon body motion or "pumping" action offered little relief. Forced air circulation through the use of a mechanical air circulator offered sufficient relief to make work at 90°F practical. The relief from the circulator was directly proportional to the volume of air moved by the fan. (Author)

Psychometric Lab., U. of North Carolina, Chapel Hill.
DEVELOPMENT OF SUITABLE PSYCHOMETRIC TECHNIQUES FOR VALID, RELIABLE AND EFFICIENT MEASUREMENT OF SUBJECTIVE REACTIONS OF TROOPS USING QM ITEMS IN FIELD TEST CONDITIONS, by Lyle V. Jones and Thomas E. Jeffrey. Rept. on Measurement of Relative Importance of Various Clothing Characteristics and Item Acceptance, Contract DA 19-129-qm-1492. Sep 60, 96p. Technical rept. R-7; FEA MRS 6002.
Order from LC mi$5.40, ph$15.30 PB 150 892

Ratings of feature importance and feature adequacy as separate and as joint predictors of user acceptance of selected clothing items are examined by regression analysis. Item features are classified in terms of relative importance and adequacy by scale value computed by the means of ratings assigned to the various features by 266 soldier subjects. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
A TECHNIQUE FOR MEASURING CLOTHING INSULATION UNDER DYNAMIC CONDITIONS, by Alan H. Woodcock and Ralph F. Goldman. July 60, 9p. 2 refs. Technical rept. EP-137.
Order from LC mi$1.80, ph$1.80 PB 150 748

The use of a Beckman & Whitley Heat-Flow Transducer for measuring fluctuations in heat loss from the human skin through clothing to the environment has been examined using two different types of clothing. The method has been found satisfactory as a technique for obtaining local effects due to ventilation caused by body movement. Of the two hot weather uniforms examined, the experimental seemed to have little or no advantage with regard to coolness. (Author)

PHYSICS

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
TECHNICAL PAPERS FROM THE QUARTERLY REVIEW OF BUMBLEBEE ACTIVITIES JANUARY-DECEMBER 1959, Rept. on Contract NOrd 7386. [1960] 69p. 24 refs. Bumblebee rept. no. 291.
Order from LC mi$3.90, ph$10.80 PB 150 872

Contents:
Radiation Patterns of Microwave Stepped-Index Luneberg Lenses.
Measurement of Laminar Flame Speeds of Ethylene-Air and Propane-Air Mixtures by the Double-Kernel Method.
Torsional Analysis of Thin-Walled Shells with Closely Spaced Spars.
Honeycomb Sandwich Panels.
Combustion Instability: Acoustic Interaction with a Burning Propellant Surface.
Stability Tests on a Bleed Simulator at Mach 2.43.
Hydraulic (Distilled Water) Servo-Operated Hot Gas Control Valve.
Insulation for Hypersonic Engines and Airframes.
Water Injection: A New Protective System for Missile Magazines.
Analysis of Bistable Control Systems.
Acquisition Search Problem.
Nutation Damping of Satellites by the Drag of Internal Fluid Motions.
(See also PB 145 094).

Yale U., New Haven, Conn.
THE THICK-WALLED HOLLOW SPHERE OF AN ELASTIC-LOCKING MATERIAL, by Aris Phillips and Asim Yaldiz. Technical rept. no. 8 on Contract Nonr-609(12). Dec 59, 32p. 3 refs. AD-232 402.
Order from LC mi$3.00, ph$6.30 PB 152 134

The purpose of this study is the exploration of the rheological concept of the locking material which was introduced by Prager (Trans. of the Soc. of Rheology, v. I (1957) p. 169-175). In another paper (Proc. IX International Congress of Applied Mechanics, v. 5 (1957) p. 205-211) Prager introduced the concept of the elastic solid of limited compressibility. By a synthesis of the two concepts, Phillips (Trans. of the Soc. of Rheology, v. III) introduced the concept of the ideal locking material represented by means of two curves. It is seen that such a material may lock either by compression or by shear. In this study the work of Prager and Phillips is extended by introducing the elastic-locking material as an extension of the ideal locking material.

Acoustics

Naval Research Lab., Washington, D. C.
THE MUTUAL MECHANICAL RADIATION RESISTANCE FOR ALL VALUES OF ka OF AN UNBAFFLED CIRCULAR RIGID PISTON WITH PRESSURE RELEASED BACK, by S. Hanish. Interim rept. 22 Sep 60, 14p. 12 refs. NRL rept. 5513.
Order from LC mi$2.40, ph$3.30 PB 147 832

The theory of the radiation of sound from one face of an unbaffled rigid piston whose second face is pressure released is reviewed in detail. Two such unbaffled pistons located in a plane with their centers separated by a distance d are driven with identical amplitudes of velocity V_0. Formulas are derived for the real acoustic power developed, the mechanical radiation self resistance and the mechanical radiation mutual resistance at all values of frequency and piston radius, and for all distances d. Procedures and equations that simplify numerical computation are discussed and amplified. Numerical calculations, however, are not included, these being reserved for a companion report. (Author)

Speech Research Lab., U. of Michigan, Ann Arbor.
LINGUISTIC CONSIDERATIONS IN THE STUDY OF SPEECH INTELLIGIBILITY (PART I); VOWEL, AMPLITUDE, AND PHONEMIC STRESS IN AMERICAN ENGLISH (PART II); [and] THE IDENTIFICATION OF FILTERED VOWELS (PART III) by Ilse Lehiste and Gordon E. Peterson. Rept. no. 3 on Studies of Syllable Nuclei, Contract Nonr-1224(22). Nov 59, 135p. 5 refs; AD-231 102.
Order from LC mi$6.90, ph$21.30 PB 150 494

Intelligibility is defined as a property of speech communication involving meaning. Since only meaningful units have normal linguistic distributional properties, only meaningful units have the phonetic properties of actual speech. An analysis is presented of the Harvard PB (phonetically balanced) lists, and a set of 10 lists of 50 monosyllables each is presented having an almost exact first order phonemic balancing. There is as yet no satisfactory method of calculating the loudness of the various types of complex quasi-periodic sounds that appear as time functions in speech, and it is suggested that any such method would be inadequate for deriving physical correlates of accent or stress judgments about speech. Volume indicator and instantaneous amplitude observations are reported on sustained vowels produced under various conditions of speech effort, and on vowels produced in CNC syllables in a carrier phrase with stress held constant. The untested theory is proposed that the perception of linguistic stress is based upon judgments of the physiological effort involved in producing vowels. A filtering technique was employed in order to determine the relative influence of the various formant frequencies upon vowel identification. When the high-pass filter admitted only formants above the third, vowel identification dropped below 5%. It was felt that vowel substitutions are predictable under certain conditions of filtering, and particular aspects of each vowel pattern are primary, or may be considered as essential information-bearing vowel parameters.

Electricity and Magnetism

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A RADIOSONDE FOR MEASURING THE AIR-EARTH CURRENT DENSITY, by Heinz Kasemir. 15 June 60, 31p. 16 refs. USASRDL Technical rept. 2125.
Order from LC mi$3.00, ph$6.30 PB 152 190

An instrument is described which, in connection with an ordinary meteorological radiosonde, measures the air-earth current density as a function of altitude. The instrument is provided with three separate channels of high input impedance which make it possible to measure three atmospheric electric elements during the same flight. A detailed analysis of the measuring technique is given, and the results of 40 test flights are discussed. (Author).

California U., Berkeley.
SURFACE WAVES OVER A LOSSY CONDUCTOR, by Bernard Friedman. Technical rept. no. 3 on Mathemat ical Aspects of Electromagnetic Theory II, Contract Nonr-222(60). Nov 59, 16p. 2 refs. AD-229 040.
Order from LC mi$2.40, ph$3.30 PB 150 880

The electromagnetic field produced by a magnetic line source on an imperfectly conducting plane was the subject of many papers (H. Bremmer, Encyclopedia of Physics, XVI). The question of whether this field contains surface waves or not remains a matter of discussion. An effort is made in the present discussion to avoid such essentially semantic notions as the existence of a surface wave. Instead, the well-known (B. Friedman and W. Elwyn Williams, Proc. Int. Elec. Eng., Part C, Jan. 58) integral representation for the field produced by the line source is studied, the integrals involved are evaluated as carefully as possible, and, most important, estimates of the error made in evaluating the integral are obtained. (Author).

Carnegie Inst. of Tech., Pittsburgh, Pa.
ELECTRIC FIELD DISTRIBUTIONS IN AN IONIZED GAS. II, by Bernard Mozer (Doctoral thesis) and Michel Baranger. Technical rept. no. 2 on Contract Nonr-760(15). [1959] 23p. 8 refs. AD-227 317.
Order from LC mi$2.70, ph$4.80 PB 150 526

A method is used to calculate the probability distribution of the low-frequency component of the electric field at a neutral point, the distribution of the low-frequency component at an ion, and that of the high-frequency component at an electron. (Author) (See also PB 144 897)

Electro-Mechanics Co., Austin, Tex.
VARIABLE MY-MAGNETOMETER. Interim engineering rept. on Contract AF 19(604)1742. 9 Apr 57, 37p. AFCRC-TN-58-409; AD-152 552.
Order from LC mi$3.00, ph$6.30 PB 150 927

The Variable-Mu Magnetometer utilizes the principle that a variation exists in the permeability of a magnetic core when the core is subjected to a varying magnetic field, such as the earth's field. The variation in permeability of the core serves to change the inductance of a coil that is wound on it. The coil and core are used as a variable inductance in an oscillating circuit causing the circuit's frequency to follow changes in the permeability of the core. A counter records the frequency of the oscillator. Consequently, the variation in a magnetic field may be indicated by the readings of the frequency counter. A number of possible core materials were tested for suitability and the Magnetic Ceramic, Ceramag 27, was found to be the most promising one. Core shapes were tested and it was determined that the double dumbbell shape produced the best results. The sampling of the earth's magnetic field taken with the variable-Mu Magnetometer (using various cores) are shown as graphs on 25 figures. (Author) (See also PB 145 570)

Geophysical Inst., U. of Alaska, College.
A STUDY OF THE MORPHOLOGY OF MAGNETIC STORMS: GREAT MAGNETIC STORMS, by Masahisa Sugiura and Sydney Chapman. Final rept. on Contract AF 19(604)2163. 31 Aug 58, 74p. 8 refs. AFCRC TR-58-266.
Order from LC mi$4.50, ph$12.30 PB 150 932

Average characteristics are determined for 74 great magnetic storms with sudden commencements that occurred in 1902-1945. The storm field is resolved for different epochs of storm time into two parts: (i) Dst, which is independent of local time, that is, of longitude λ, relative to the sun, and (ii) DS, which depends on λ. They are obtained, for each of the three magnetic elements, declination, horizontal force, and vertical force, at eight geomagnetic latitudes ranging from 80°N to 1°S. DS is harmonically analyzed; the first harmonic component is shown to be the main component of DS. The storm-time course of this component is compared with that of Dst; DS attains its maximum earlier and decays more rapidly. The results of the analysis of great storms are compared with those for weak and moderate storms that were reported previously. Some characteristics of Dst change with intensity. Except in magnitude, main characteristics of DS are independent of intensity. (Author).

Metals Research, Ltd. (Gt. Brit.)
RESEARCH ON IMPROVED MATERIALS FOR HYSTERESIS MOTORS. Final technical rept. for 15 Mar-14 June 60 on Contract DA 91-591-EUC-1157. Aug 60, 38p. 62 refs.
Order from LC mi$3.00, ph$6.30 PB 150 644

An extensive literature search showed that the main requirements of materials for the rotors of hysteresis motors are (i) maximum induction, (ii) a coercivity of 60-100 oersteds, (iii) a very square B-H loop, and that suitably sintered compacts of equiatomic iron cobalt alloy powders should have the desired properties. The particle size of the powders must be such that each particle contains only a few domains and the particles should be acicular; for optimum magnetic properties they should be aligned before compacting and finally annealed in a magnetic field. Techniques have been developed for the production of compacts of fine iron cobalt alloy powders; in this preliminary work, however, the powders were produced by decomposition of organic metal salts and were larger and more spherical than ideal and no attempt was made to align them before compacting.

Electronics

Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATIONS OF RARE-EARTH OXIDE CATHODES, by J. B. Baker and G. B. Gaines. Scientific rept. no. 3 on Contract AF 19(604)5691. 1 May 60, 9p. ERD-TN-60-774.
Order from LC mi$1.80, ph$1.80 PB 150 424

The thermionic emission from a mixture of 75 per cent neodymium oxide and 25 per cent gadolinium oxide is being studied. The oxide mixture was applied to

rhenium and to undoped tungsten electrophoretically. Heating the oxides on undoped tungsten wires to temperatures of about 1300°C (brightness) or above resulted in permanent reduction of the emission capabilities. On the other hand, heating the oxides on rhenium wires to temperatures up to 1540°C temporarily improved the emission. Emission from both types of cathodes was erratic, and true values for the emission constants probably have not been obtained. In future work, other oxides and base metals will be used. (Author) (See also PB 145 734)

Case Inst. of Tech., Cleveland, Ohio.
HIGHER ORDER EVALUATION OF THE DIFFRACTION OF A PLANE WAVE BY A SMALL CIRCULAR DISK, by Wilhelm H. Eggimann. Scientific rept. no. 14 on Contract AF 19(604)3887. 7 July 60, 50p. 17 refs. ERD-TN-60-767.
Order from LC mi$3.30, ph$7.80 PB 152 077

The current distribution on a small circular disk due to an incident plane wave has been obtained as a power series in (ka). This representation lends itself easily to the calculation of the scattered field in terms of elementary functions. Expressions for higher order multipole moments can be computed; for that purpose some elementary integrals are given in table III and IV in the appendix. Recently Lur'e has obtained a solution of this problem by reducing it to a pair of Fredholm integral equations of the first kind. He obtained an expression for the scattering cross-section which agrees with the result in this paper. This implies therefore the correctness of the coefficients for the current distribution. (Author)

General Electric Co., Schenectady, N. Y.
INVESTIGATION OF VARIOUS ACTIVATOR-REFRACTORY SUBSTRATE COMBINATIONS, by J. H. Affleck. Scientific rept. no. 7 on Contract AF 19(604)4093. 15 Mar 60, 13p. 3 refs. AFCRC-TN-60-183; AD-234 797.
Order from LC mi$2.40, ph$3.30 PB 148 254

A number of dispenser cathodes have been prepared, composed of a refractory matrix containing barium silicide. The tungsten carbide system has the lowest work function of those examined. In addition to thermionic data, tubes are being designed which will permit the determination of the barium evaporation rate. (Author) (See also PB 145 364)

Marine Physical Lab., Scripps Institution of Oceanography, San Diego, Calif.
THE HORIZONTAL ELECTRIC DIPOLE IN A CONDUCTING HALF-SPACE, by Alfred Banos, Jr. and James Paul Wesley. Rept. on Contract NObsr-43356. Sep 53, 238p. 49 refs. SIO Reference 53-33.
Order from LC mi$10.20, ph$36.30 PB 152 676

This report released for sale to the public 16 Nov 60.

This report gives a thorough and complete account of the mathematical problems involved in the determination of the electromagnetic field components generated by a horizontal electric dipole embedded in a conducting half-space whose plane boundary is also horizontal. The problem is formulated by introducing the Hertzian vectors or polarization potentials and employing the technique of triple Fourier transforms in Cartesian coordinates, in configuration space as well as in transform space. Suitable integral representations are obtained for the components of the Hertzian vectors. It is shown that this formulation is fundamental in the sense that it contains 'per se' all other known formulations of the problem. By correctly specifying the original path of integration in Sommerfeld's formulation of the problem and by carefully analyzing the class of permissible deformations of the original path, the whole moot question of poles and residues is clarified in a straightforward manner. The report also presents the complete independent solution of the static problem and it is shown that all solutions for the alternating case converge uniformly to the static solutions as the frequency is made to vanish.

National Bureau of Standards, Washington, D. C.
SOVIET RESEARCH IN FIELD ELECTRON AND ION EMISSION, 1955-1959; AN ANNOTATED BIBLIOGRAPHY, by Tibor W. Marton and Ralph Klein. Oct 60, 41p. 122 refs. Technical note. 75.
Order from OTS $1.25 PB 161 576

Soviet field emission research, as reflected in the technical literature from 1955 through 1959, is the subject matter of this annotated bibliography. Topics include experimental and theoretical work on field electron emission from metals and semiconductors, work functions, phase transformations, adsorption, diffusion, evaporation, surface ionization, and field ion emission. Over one hundred complete references to original publications in Russian and Ukrainian and to a few in Polish, Hungarian, and Czech were selected after an extensive search of the literature. Full references are given to English translations of the entries whenever available. A list of relevant scientific meetings, references, and a brief subject index are appended to the compilation. (Author)

Rome U. (Italy).
MODES IN RECTANGULAR GUIDES PARTIALLY FILLED WITH TRANSVERSELY MAGNETIZED FERRITE, by Giorgio Barzilai and Giorgio Gerosa. Scientific note no. 1 on Contract AF 61(052)101. 3 June 59, 19p. 4 refs. AFCRC-TN-59-785.
Order from LC mi$2.40, ph$3.30 PB 150 413

A general model solution for a rectangular guide partially filled with a slab of ferrite transversely magnetized and situated against one side wall is considered. The relative characteristic equation, which has been obtained in a previous work, is numerically solved for some typical cases and for modes of zero, first and second order with respect to the dependence along the direction of the d. c. magnetic field. The results are summarized in twentyone diagrams giving the propagation constant versus the ferrite slab thickness. From the preceding analysis it can be concluded that: (a) propagating modes of any order may exist; (b) modes of zero order may not be the lowest propagating modes in the sense that higher order modes can propagate when zero order modes are attenuated; (c) cases can exist when all the unattenuated propagating modes travel in the same sense. (Author)

Stanford Electronics Labs., Stanford U., Calif.
SERIES SOLUTIONS FOR PERTURBATIONS ON CROSSED-FIELD BEAMS, by B. A. Wightman and D. Chen. Rept. on Contract Nonr-225(24). 9 Nov 59, 22p. 5 refs. Technical rept. no. 207-2; AD-229 950.
Order from LC mi$2.70, ph$4.80 PB 150 822

The differential equation of perturbations on the Brillouin state of a rectilinear beam in crossed fields is presented. The solutions of this differential equation have limited value for computational purposes. Series developments are given of these solutions, and the numerical values of the coefficients are tabulated in a form adapted to high-speed digital computation. The same information is given for a determinantal function formed from these solutions and applicable to boundary-value problems involving such a beam. An example problem is solved using this determinantal function. (Author).

Stanford Electronics Labs., Stanford U., Calif.
TRAVELING-WAVE AMPLIFICATION OF WHISTLERS by N. M. Brice. Technical rept. no. 7 on Contract AF 18(603)126. 16 Aug 60, 8p. 5 refs. AFOSR-TN-60-931; AD-243 601.
Order from LC mi$1.80, ph$1.80 PB 150 820

Assuming that the traveling wave amplification mechanism is operative in the outer ionosphere, it is shown that amplification and absorption of audio frequency waves depend on their rate of change of frequency with time. For a descending gliding tone, as in a whistler, there is inherent in its propagation a bias in favor of amplification of the wave. (Author)

Tung-Sol Electric, Inc., Bloomfield, N. J.
RESEARCH AND DEVELOPMENT IN UTILIZATION OF SELF-SUSTAINED ELECTRON EMISSION INVESTIGATION, by B. G. Firth, Warren C. Johnson, and Donald W. Mayer. Quarterly rept. no. 1, 1 Jan-31 Mar 60, on Contract DA 36-039-sc-85120. [1960] 50p. 2 refs. AD-237 920.
Order from LC mi$3.30, ph$7.80 PB 150 450

The characteristic physical, chemical, and electrical properties of the MgO cold cathode and its preparation are reviewed. Development of 499 "Alloy" nickel sleeve preparation for such cathodes was very satisfactorily and finally completed. A method of stereoscopic photomicrographic analysis of cathode coating structures was developed for use as a tool for correlating said structures with cathode preparation and subsequent electrical test results. A careful study of "pop-out" (sudden emission failure) shows this phenomenon to be caused by reduction of coating surface charge due to rapid rise of MgO conductivity with rise in temperature as a result of power dissipation in the coating. Research established the fact that materials other than MgO, such as Al_2O_3 and BeO, can be made to give the same type of self-sustained electron emission. (Author)

Molecular Physics and Spectroscopy

Columbia U., New York.
ANOMALOUS RELAXATION OF HYPERFINE COMPONENTS IN ELECTRON SPIN RESONANCE. II, by Jan W. H. Schreurs and George K Fraenkel. Technical note rept. no. 5 on Research in Electron Spin Resonance, Contract AF 49(638)520. 1 Aug 60, 47p. 28 refs. CU-5-60-AF-520-Chem.; AFOSR-TN-60-863.
Order from LC mi$3.30, ph$7.80 PB 150 430

A detailed study has been made of the line width and peak height of each of the five components in the electron spin resonance spectrum of the p-benzosemiquinone ion as a function of microwave power at X-band frequencies. Studies were also made of the spectrum of the peroxylamine disulfonate ion as a function of power. A 20 percent variation in the line widths from one hyperfine component to another was found in the p-benzosemiquinone ion spectrum, and a 13 percent variation in the saturation parameters (T_1). The average value for the line-width parameter at low power for the p-benzosemiquinone ion was found to be $(1/T_2) = 1.11 \times 10^6$ sec^{-1}, and the reciprocal of the average value of the saturation parameter was found to be about $(1/T_1) = 0.74 \times 10^6$ sec^{-1}. (See also PB 146 749).

Columbia U., New York.
ELECTRON SPIN RESONANCE SPECTRUM OF THE CYCLOOCTATETRAENYL RADICAL ANION, by Thomas J. Katz and Herbert L. Strauss. Technical note rept. no. 4 on Research in Electron Spin Resonance, Contract AF 49(638)520. 1 Apr 60, 6p. 15 refs. CU-4-60-AF-520-Chem; AFOSR-TN-60-589. AD-242 503.
Order from LC mi$1.80, ph$1.80 PB 150 429

Columbia U., New York.
MOLECULAR ORBITAL THEORY AND HYPERFINE SPLITTING IN ELECTRON SPIN RESONANCE SPECTRA OF SEMIQUINONES, by Gershon Vincow and George K. Fraenkel. Technical note rept. no. 6 on Research in Electron Spin Resonance, Contract AF 49(638)520. 15 Aug 60, 36p. 24 refs. CU-6-60-AF-520-Chem.; AFOSR-TN-60-920. AD-242 505.
Order from LC mi$3.00, ph$6.30 PB 150 431

Molecular orbital calculations of the unpaired electron density in a number of semiquinone ions have been made as a function of a range of values of the Coulomb integral, α_O, for the oxygen atom and the resonance integral, β_{CO}, between the oxygen atom and the carbon atom. The unpaired-electron densities, ρ_i, were compared with the experimental hyperfine splitting constants a_i arising from the proton bonded to carbon atom i by the use of McConnell's relation $a_i = Q\rho_i$. Excellent agreement is obtained for the proper choice of α_O and β_{CO}.

Columbia U., New York.
NOTE ON THE CALCULATION OF SATURATION EFFECTS IN MAGNETIC RESONANCE, by M. J. Stephen. Technical note rept. no. 7 on Research in Electron Spin Resonance, Contract AF 49(638)520. 15 Aug 60. 19p. 6 refs. CU-7-60-AF-520-Chem.; AFOSR-TN-60-919. AD-242 506.
Order from LC mi$2.40, ph$3.30 PB 150 432

A simple method using diagrams is described for calculating saturation parameters in spin systems. Results are derived for the multiresonance case. The lattice is regarded as inducing transitions amongst the various spin levels and the transition probabilities are assumed known. The method is particularly useful in complicated spin systems as are found in organic free radicals. For a free radical in solution with one odd electron and N equivalent nuclei under conditions where the intramolecular electron nuclear dipole-dipole interaction and g factor anisotropy contribute to the relaxation, the dependence of the saturation parameters of the electron resonance spectrum on the nuclear quantum number mJ is given by an expression of the form $Am_J^2 + Bm_J + C$. Such behavior has been found experimentally. (Author).

Electronics Research Lab., U. of California, Berkeley.
ELECTRON SPIN RESONANCE IN NEUTRON-IRRADIATED CALCITE, by J. C. Kemp. Rept. on Contract AF 49(638)102. 5 July 60, 6p. 5 refs. IER series no. 60, issue no. 293; AFOSR TN-60-601; AD-242 247.
Order from LC mi$1.80, ph$1.80 PB 150 374

Institute of Mathematical Sciences, New York U., N. Y.
BOUNDS ON SCATTERING PHASE SHIFTS: STATIC CENTRAL POTENTIALS, by Leonard Rosenberg and Larry Spruch. Rept. on Contracts AF 19(604)4555 and DA 30-069-ORD-2581. June 60, 35p. 21 refs. Research rept. no. CX-49; AFCRC TN-60-464 [sic].
Order from LC mi$3.00, ph$6.30 PB 150 945

It has recently been shown that rigorous upper bounds on scattering lengths can be obtained by adding to the Kohn variational expression certain integrals involving approximate wave functions for each of the negative energy states. For potentials which vanish identically beyond a certain point, it is possible to extend the method to positive energy scattering; one obtains upper bounds on $(-k \cot \eta)^{-1}$, where η is the phase shift. In addition to the negative energy states one must now take into account a finite number of states with positive energies lying below the scattering energy. The states in this associated energy eigenvalue problem are defined by the imposition of certain boundary conditions on the wave functions. A second approach, involving an associated potential strength eigenvalue problem, is also used. The second method includes the first as a special case and, more significantly, can be extended to scattering by compound systems. If some states are not accounted for, a bound on $\cot \eta$ is not obtained; nevertheless it is still possible to obtain a rigorous lower bound on η. Upper bounds on η may also be obtained, but in a way which is probably not too useful for many body scattering problems. (Author).

Kansas State U., Manhattan.
THE SPECTRA OF NITROGEN OXIDES, by I. C. Hisatsune. Final rept. for 1 May 57-31 Aug 60 on Contracts AF 19(604)2255 and AF 19(604)6622. Aug 60, 23p. 52 refs. GRD-[TR]-60-296.
Order from LC mi$2.70, ph$4.80 PB 150 096

Infrared absorption bands of some oxides of nitrogen in the one to thirty micron region and in the gas, liquid, and/or solid phases have been investigated using a medium resolution infrared spectrometer. Normal coordinate analyses using the Urey-Bradley potential field have also been carried out on several of these nitrogen oxides. The results of these experimental and theoretical work are briefly summarized in this report. The following papers are included: Existence of N_2O_4 isomers, by I. C. Hisatsune and J. P. Devlin, Pub. in Jnl. of Chemical Physics 31:1130-1131, Oct 59, the Raman spectrum and the structure of N_2O_3, by I. C. Hisatsune and J. P. Devlin pub. in Spectrochimica Acta 16:401-406, 16 Nov 59, Urey-Bradley potential constants in nitrogen dioxide, nitrate ion and dinitrogen tetroxide, by I. C. Hisatsune, J. P. Devlin and S. Califano. Pub. in Spectrochimica Acta 16:450-458, 1960. (See also PB 143 667).

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
DE-IONIZATION CROSS SECTION FOR OXYGEN, by R. G. Breene, Jr. Rept. on Contract AF 04(647)269. 20 July 60, 24p. 10 refs. Technical Information Series R60SD409.
Order from LC mi$2.70, ph$4.80 PB 150 949

Our atomic and free electron wave functions are applied to the calculation of the de-ionization cross section for OII. Our s- and d-wave numerical solutions to the free electron wave equation is fitted to Coulomb functions for normalization. This result is used to determine the cross-section for the transitions s-wave to 2p orbital and d-wave to 2p orbital. We carried out an approximate calculation for the transition to the 3p orbital with the resulting indication that the hydrogen result may reasonably be used. For the contributions from transitions to 3d and higher orbitals the hydrogen cross-sections have been adopted. Our final result is 198×10^{-21} cm.^{2} leading to a rate constant for radiative de-ionization of 218×10^{-14}. (Author)

Stanford U., Calif.
PROTON RESONANCE SHIFTS IN PYRENE MONO-NEGATIVE ION AT 4.2°K, by M. E. Anderson, P. J. Zandstra, and T. R. Tuttle, Jr. Rept. on Contracts AF 49(638)482 and AF 18(603)131. [1960] 4p. 4 refs. AFOSR-TN-60-904; AD-242 738.
Order from LC mi$1.80, ph$1.80 PB 150 378

Optics

Centro di Studio per la Fisica delle Microonde (Italy).
STEPPED CYLINDRICAL MIRRORS CORRECTED FOR APERTURE AND FIELD ABERRATIONS, by Laura Ronchi Abbozzo, Vera Russo and Giuliano Toraldi Di Francia. Technical note no. 1 on Contract AF 61(052)234. Feb 60, 22p. 5 refs. AFCRC-TN-60-565.
Order from LC mi$2.70, ph$4.80 PB 150 415

In this paper a stepped zone cylindrical mirror is described which satisfies the following requirements: (1) it is free from spherical aberration for a point source at infinity on the axis, (2) both off-axis spherical aberration and coma vanish for fixed values of the field angle, $\bar{\Omega}$, and of the aperture, $\bar{\theta}$. The analysis has been carried out, in the approximation of parageometrical optics, by considering a diffraction grating of the generalized type, equivalent to the stepped zone mirror. Three interesting results are obtained: independently of the values of $\bar{\Omega}$ and $\bar{\theta}$, the equivalent diffraction grating has a quasi-parabolic cross-section; the off-axis spherical aberration turns out to be negligible over the whole aperture $0-\bar{\theta}$, for field angles up to at least 20°; and the residual coma turns out to be well corrected, too. (Author)

Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.
SCATTERING BY IMPERFECT GRATINGS, by M. Bottema. Final rept. on Contract AF 19(604)3491. 31 Dec 59, 31p. 6 refs. AFCRC-TR-60-265.
Order from LC mi$3.00, ph$6.30 PB 150 628

The irreducible erratic errors of groove spacing in a diffraction grating, although relatively small in gratings with a spacing suitable for use in the visible spectrum, may be seriously large when gratings will be made with smaller spacing, ruled for the vacuum ultraviolet or X-ray spectrum. This report gives a theoretical analysis of the effect of erratic groove spacings and observations with experimental gratings with built-in erratic spacing errors. Observations and theory are compared. A similar investigation, on gratings with erratic errors in groove depth, is also described. (Author)

Solid State Physics

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
SHORT CARRIER LIFETIMES AND THE PHOTOMAGNETOELECTRIC EFFECT, by Frank A. Brand. 15 Aug 57, 49p. 61 refs. Technical memo. no. M-1918; AD-156 260.
Order from LC mi$3.30, ph$7.80 PB 150 686

The PME effect, which is based on the diffusion of optically excited carriers in the presence of a transverse magnetic field, was utilized to study carrier lifetimes in germanium. The effect is analyzed assuming electron-hole generation is confined to one surface of an infinite slab, and expressions for the relative conductance change, PME short circuit current, Dember voltage, and Dember field are developed on an ambipolar basis. Equations for carrier lifetime under thick or thin sample conditions are derived independent of light intensity by considering the ration of relative conductance change to short circuit PME current. Methods for measuring the relative conductance change and PME response are presented in some detail, and the experimental limits encountered for the various measurements are indicated. Data obtained on 20 germanium slabs are presented in tabular form showing measured lifetime values ranging from 5×10^{-4} to 2×10^{-9} sec. Comparisons between long lifetime specimens measured by the PME effect and other more conventional techniques such as photoconductive decay or Morton-Haynes method are made showing very good agreement in all cases. The effects of adding recombination centers such as nickel or copper by solid state diffusion show how carrier lifetime can be effectively degraded in germanium by orders of magnitude. In addition, increasing the density of dislocation centers by heat-quench cycling is also observed to reduce lifetime, though not as drastically as is possible by chemically adding recombination centers.

Bell Telephone Labs., Inc. [New York].
FUNDAMENTAL STUDIES OF THE PROPERTIES OF NATURAL AND SYNTHETIC QUARTZ CRYSTALS, by J. C. King. Final rept. for 1 Feb 55-10 June 60 on Contract DA 36-039-sc-64586. 10 June 60, 95p. 50 refs. Rept. no. 27424-0; AD-238 614.
Order from LC mi$5.40, ph$15.30 PB 150 680

Starting with the results of measurements of the steady-state electrical conductivity in quartz from 500°C down to room temperature, a review is made of the resonator behavior of synthetic quartz derived from various seed plate orientations from -60° to 100°C. Without any attempt at preserving the chronological order of the work, the report proceeds with a description of deformation and diffusion-type mechanical relaxation phenomena found in quartz. These absorption processes are found to have direct bearing on the behavior of thickness shear resonators over the temperature range -60° to 100°C. Thus studies of methods by which the amplitude of these relaxation absorptions can be altered lead not only to further knowledge of the underlying defect but also to techniques for improving the elastic properties of synthetic quartz resonators. The acoustic absorption commonly found near 20°K in 5-mc thickness shear resonators is described and compared with analytical treatments of dislocation relaxation in crystals. (Author) (See also PB 149 724)

California U., Los Angeles.
THE ATTENUATION OF SOUND IN ALUMINUM AND SILVER AT LOW TEMPERATURES, by Edward Lax. Technical rept. no. 17 on Contract [Nonr]-233(48). Dec 59, 93p. 55 refs; AD-230 867.
Order from LC mi$5.40, ph$15.30 PB 152 144

The present study examined the attenuation of sound due to the electron-lattice interaction in the normal conducting state of metals. A comparison with theory was made by measuring both the ultrasonic attenuation and the electrical conductivity of the same or similar samples over a wide temperature range. Except for copper, which yielded curious results, only metals with complicated electronic or crystalline structures were measured in the past. All previous measurements were made above 9 mc by pulse techniques, usually in single crystals to avoid grain boundary scattering. In the experiments described here, Al and Ag, both face centered cubic metals with almost spherical Fermi surfaces, were studied. Aside from measurements in superconducting Al, the effect was not previously examined in these simple metals. The acoustic measurements were made in high purity polycrystalline specimens at low frequencies by the reverberation decay method. (Author).

Cornell U., Ithaca, N. Y.
INVESTIGATIONS ON THE DEPOSITION OF CADMIUM ON MICA SURFACES, by Gregory Soh-Yu Yeh. Technical rept. no. 17 on Theoretical and Experimental Investigations of the Atomic Phenomena Occurring on and Near the Surfaces of Solids, Contract AF 18(600)674. 15 June 60, 49p. 15 refs. AFOSR-TN-60-755.
Order from LC mi$3.30, ph$7.80 PB 152 036

The nucleation and growth of cadmium crystallites during deposition from the vapor phase on mica has been investigated using the electron microscope. In the range of incident vapor densities studied, the mica must be cooled to temperatures below -70°C before critical nuclei will form. At temperatures above -120° to -130°C nucleation appears to be very rapid and subsequent deposition causes only growth of the crystallites. When the mica substrate is cooled below -130°C the number of nuclei formed per unit area is proportional to the time of deposition and the activation energy of the process is much lower (1,400 cal/mol) than the process occurring on the warm substrates (5,900 cal/mol). By direct observation of these deposits with the electron microscope, data is obtained on the number and rate of crystallite nucleation, as well as the size and rate of growth of the crystals during deposition. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
DETECTION OF HIGH-POWER MICROWAVES BY FERRITES AND GARNETS, by D. Jaffe, J. C. Cacheris, and N. Karayianis. 5 Oct 60, 15p. 4 refs. TR-867.
Order from LC mi$2.40, ph$3.30 PB 152 310

Measurements of the low-frequency (detection) component of m_Z in ferrite and garnet as a function of microwave power are presented. Most of the measurements were made on rods of garnet having line widths on the order of tens of oersteds. The detected output is obtained by a coil of wire wrapped around the garnet rod, critically loaded by a resistor. The efficiency, defined as the ratio of the power in the resistor to the microwave power, is only on the order of 10^{-5} even at high rf power levels. (Author)

Illinois U., Urbana.
COLOR CENTERS IN KCl AND KBr, by John Cape and Gilbert Jacobs. Technical rept. no. 2 on Physics of the Solid State, Contract Nonr-1834(19). Nov 59, 17p. 10 refs.
Order from LC mi$2.40, ph$3.30 PB 150 543

Potassium chloride and potassium bromide crystals were exposed to X rays at 10°K. The optical absorption produced by this irradiation and the changes in optical absorption produced by subsequent annealing at higher temperatures were measured. The temperatures at which changes in optical absorption occurred were correlated with the temperatures at which free electrical charge appeared, and thermoluminescence was observed. The absorption band at 345 mμ, in KCl, which has been named the H band, was shown to possess a component caused by self-trapped holes. In KCl, the self-trapped hole band bleaches thermally at 43°K with a release of free electrical charge. H centers disappear at 56°K with a release of free charge. The optical absorption band of the H center was shown to have its maximum at 335 mμ. In KBr, the thermal release of free charge at 30°K is attributed to the disappearance of H centers. No charge burst was observed in KBr which may be attributed to the destruction of self-trapped holes. (Author).

Illinois U., Urbana.
TRANSPORT NUMBER IN SOLID CESIUM BROMIDE, by Neal Laurance. Technical rept. no. 3 on Physics of the Solid State, Contract Nonr-1834(19). Nov 59, 9p. 7 refs. AD-229 494.
Order from LC mi$1.80, ph$1.80 PB 150 544

The transport number of CsBr single crystals was measured over the temperature range 350° to 450°C by the method of Tubandt. No temperature dependence is observed, and the average value of the cation transport number is .49±.05. A preferential growth phenomenon is described, and its possible interference with the measurement is discussed. It is estimated that the true cation transport number may be as low as 0.3 because of this phenomenon. (Author)

Institute of Tech., U. of Minnesota, Minneapolis.
ON THE KINETICS AND MECHANISM OF PRECIPITATION OF LITHIUM FROM GERMANIUM, by J. R. Carter, Jr. and R. A. Swalin. Technical rept. no. 1 on Contract Nonr-710(27). 25 Nov 59, 40p. 23 refs. AD-233 797.
Order from LC mi$3.00, ph$6.30 PB 150 501

The investigation of the precipitation of Li from Ge was undertaken to determine (1) precipitation rates in crystals supplied from various sources, (2) the effect of thermal history prior to introduction of Li, and (3) the influence of selective impurity additions (O and Cu) on the kinetics of the precipitation of Li. The basic technique involved the saturation of a sample of Ge with Li at a high temperature and the subsequent quenching to a lower temperature where precipitation of the Li occurred. The progress of precipitation was followed by using electrical resistivity techniques. The precipitation kinetic data followed Ham's theory qualitatively (J. Phys. Chem. Solids 6:335, 1958) if the Li were introduced at a high temperature. The crystals which were obtained from different sources yielded drastically differing values of the apparent nuclei number density. A 2-hr 900° anneal of the Ge prior to saturation with Li increased the number of nuclei for all samples. Doping the Li with O and Cu tended to increase and decrease, respectively, the nuclei number density.

ITT Labs., Nutley, N. J.
STUDY OF THE INFLUENCE OF ATMOSPHERE AND ANNEALING ON CRYSTAL GROWTH PERFORMED WITH ELECTRICALLY SUSTAINED HEAT SOURCE, by A. J. Marino and W. L. Harries. Final engineering rept. on Contract AF 19(604)2261. July 60, 162p. 295 refs. AFCRC-TR-60-149.
Order from LC mi$7.80, ph$25.80 PB 150 547

This study was undertaken to investigate the various parameters of the flame fusion technique, the effects of

impurities, techniques for further treating the crystals after growth, and to engineer and design a process which will produce more perfect crystals.

Kentucky Research Foundation, Lexington.
SOME SEMICONDUCTING PROPERTIES OF BISMUTH TRISULFIDE AND BISMUTH TRIOXIDE, by D. M. Mattox. Technical note on Electrical, Optical and Thermal Properties of the M_2^{VB} N_3^{VIB} Semiconductors, Contract AF 49(638)90. 31 July 60, 47p. 17 refs. AFOSR-TN-60-1028.
Order from LC mi$3.30, ph$7.80 PB 150 784

Contents: Part I Sample Preparation; Bi_2S_3, bulk, dendrites, films, polycrystalline; Bi_2O_3 bulk, films; Part II Measurements; Thermal energy gaps, Bi_2S_3, Bi_2O_3, electrical resistivity, Bi_2S_3, single crystals, polycrystalline; Bi_2O_3, films, thermal conductivity, Bi_2S_3, single crystal; polycrystalline; Seebeck coefficient for Bi_2S_3, optical transmission, Bi_2S_3, Bi_2O_3, infrared transmission, Hall measurements.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
CRYSTAL PHYSICS. Annual summary rept. no. 1, 15 June 58-15 Nov 59, on Contract Nonr-1841(50). Nov 59, 38p. 18 refs. Technical rept. no. 144; AD-229 196.
Order from LC mi$3.00, ph$6.30 PB 150 541

Contents:
Preparation of solid solutions of ammonium aluminum chromium alum from $(NH_4)Cr(SO_4)_2 \cdot 12H_2O$ and $(NH_4)Al(SO_4)_2 \cdot 12H_2O$
Purification of alkali halides by zone-melting technique
Growth of cesium chloride crystals
Influence of the growing direction on the ionic conductivity of KBr single crystals
Ionic conductivity of TlCl, TlBr, and mixed crystal of TlCl/TlBr
Investigation of crystal defects by thermal etching
Crystal growth by flame fusion
Investigation of color centers in cesium halide crystals
Influence of mono- and trivalent impurities on color centers in CaF_2
Color centers in alkaline earth halides

Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE CHEMICAL ANALYSIS OF MANGANESE-MAGNESIUM FERRITE (MEMORY-CORE MATERIAL) by D. G. Wickham. Rept. on Contract AF 19(122)458. 23 Aug 57, 6p. 1 ref. Technical rept. no. 164; AD-150 870.
Order from LC mi$1.80, ph$1.80 PB 150 673

Procedures are given for the determination of iron, manganese and magnesium in manganese-magnesium ferrite. A procedure is also described for the determination of the value $Mn^{+++} - Fe^{++}$ present in the solid ferrite. These four determinations make it possible to compute the ratio of divalent metal to trivalent metal, M^{++}/M^{+++}. The complete chemical analysis is applied to an examination of memory cores before and after a refiring treatment carried out at 1050°C in an atmosphere of nitrogen. The ratio M^{++}/M^{+++} was found to remain unchanged and equal to the theoretical value for a perfect 2-3 spinel ($M^{++}M_2^{+++}O_4$). (Author)

Lincoln Lab., Mass. Inst. of Tech.; Lexington.
SOLID STATE RESEARCH. Quarterly progress rept., Div. 8, on Contract AF 19(604)5200. 15 Apr 60, 99p. 74 refs. AFCRC-TN-60-1007; AD-239 537.
Order from LC mi$5.40, ph$15.30 PB 150 603

Contents:
Semiconductor device design
Chemistry
Materials research
Band structure of groups
Microwave and magnetic properties of solids
Magnetic materials
Magnetic films
Semiconducting components
Display techniques

Lincoln Lab., Mass. Inst. of Tech., Lexington.
STRUCTURE AND MAGNETIC PROPERTIES OF PEROVSKITES, by Aaron Wold. Rept. on Contract AF 19(604)5200. 29 Aug 60, 11p. 20 refs. 53 G-0040.
Order from LC mi$2.40, ph$3.30 PB 150 757

The principal effects responsible for the crystal structure of rare-earth transition metal perovskites (ABO_3), ionic size and electronic ordering, are discussed. The further relationship between these two effects and the magnetic properties of several perovskite systems is described. Extreme purity of the rare earth constituents is found to have important effects on the phenomenon of parasitic ferromagnetism in perovskites, which indicates the desirability of re-examination of previous investigations. (Author).

Lockheed Aircraft Corp., Sunnyvale, Calif.
ELECTRON SPIN RESONANCE IN SINGLE CRYSTALS OF $SrTiO_3$, by W. I. Dobrov, M. E. Browne, and R. F. Vieth. Technical memo. Sep 59, 49p. 16 refs. LMSD-49730; AD-226 691.
Order from LC mi$3.30, ph$7.80 PB 150 666

The intensities of paramagnetic resonance lines in $SrTiO_3$ were correlated to the Fe concentrations. Evidence for attributing the origin of the resonance in titanates to Fe^{3+} impurities rather than to the domain structure was obtained. In $SrTiO_3$ resonance experiments over the range 300°K to 1.9°K show a slow continuing increase of the tetragonal component of the crystalline field down to the ferroelectric region. Applications of an electric field in this region revealed little effect on crystalline splittings, thus showing that the ferroelectric state of $SrTiO_3$ is not an induced one. Discrepancies between experimental results and conventional Hamiltonian were reinterpreted as originating from residual stress in the crystal. From intensity considerations the transitions were identified by their quantum numbers. (Author)

Materials Research Lab., Watertown Arsenal, Mass.
CRYSTALLINE FIELD AND SPIN POLARIZATION EFFECTS ON ELECTRON DENSITIES AND MAGNETIC FORM FACTORS, by A. J. Freeman and R. E. Watson (Mass. Inst. of Tech.). June 60, 19p. 22 refs. MRL rept. no. 79.
Order from LC mi$2.40, ph$3.30 PB 148 918

The combined effects of spin (or exchange) polarization and an external crystalline field on charge densities, X-ray and magnetic form factors, and hyperfine parameters are investigated following the analytic Hartree-Fock self consistent field approach. The crystalline field was represented by a crude cubic field arising from an octahedral array of point charges surrounding the central ion - in this case Ni^{+2}. The ion's spin density leads to a Fermi contact hyperfine term in better agreement with experiment than the value reported in an earlier spin polarized calculation for the free Ni^{2+} ion and a magnetic form factor whose Fourier transform resembles none of the individual 3d charge distributions. (Author)

Materials Research Lab., Watertown Arsenal, Mass.
ON "SCREENED IMPURITY POTENTIALS IN METALS", by Ralph J. Harrison and Arthur Paskin. July 60, 5p. 5 refs. MRL rept. no. 81.
Order from LC mi$1.80, ph$1.80 PB 148 830

McIrvine recently examined the spatial form of the screened potential obtained from the work of Takimoto. The present note points out some limitations in McIrvine's approach. In particular, the authors reemphasize the importance of the screening arising from electrons at the Fermi surface. This contribution, neglected by McIrvine, was shown earlier by Langer and Vosko to be dominant at large distances. (Author).

Materials Research Lab., Watertown Arsenal, Mass.
ON THE CALCULATION OF THE CRYSTALLINE FIELD STRENGTH, by A. J. Freeman and R. E. Watson (Mass. Inst. of Tech.). June 60, 18p. 44 refs. MRL rept. no. 80.
Order from LC mi$2.40, ph$3.30 PB 148 919

A calculation of the crystalline field strength, Dq, is reported for the case of chrome alum, using the same model and crystal field potential employed by Kleiner and recently determined Hartree-Fock wave functions for the Cr^{+3} ion. Particular emphasis is placed on a consideration of reported point charge calculations and Phillips' method of including the effects of orthogonalization of ligand to metal ion wave functions. Our results indicate that the point charge model estimates for Dq gave good results mostly because they were based on the use of improper 3d wave functions. Kleiner's result is significantly improved - his wrong sign for Dq is reversed and a small positive Dq is obtained - but in such a way as to contradict Phillips conclusions. (Author)

Materials Research Lab., Watertown Arsenal, Mass.
THE UNRESTRICTED HARTREE-FOCK METHOD: ELECTRON DENSITIES AND MAGNETIC FORM FACTORS FOR SPIN POLARIZED Ni^{++}, by A. J. Freeman and R. E. Watson (Mass. Inst. of Tech.). June 60, 23p. 46 refs. MRL rept no. 78.
Order from LC mi$2.70, ph$4.80 PB 148 917

The effect of relaxing the restrictions associated with the Hartree-Fock method are discussed with particular emphasis on that constraint which requires common radial behavior for wave functions with all quantum numbers except m_s (spin direction) in common. Results of such a "spin polarized" Hartree-Fock self consistent field calculation are reported for the Ni^{+2} ion and related to earlier calculations of Wood and Pratt, and Heine. Emphasis is placed on a consideration of the effects on electron density and on X-ray and magnetic form factors. The calculation suggests that one would obtain a magnetic form factor which is measurably expanded (hence a contracted charge distribution) in comparison with that appropriate for any single 3d electron. Also presented are results of calculations of several hyperfine parameters. (Author)

Minnesota U., Minneapolis.
STUDY OF THE NATURAL AND INDUCED MAGNETIC SPECTRA OF SOME FERRITES, by A. H. Morrish. Final rept. on Contract AF 18(603)113. July 60, 53p. 9 refs. AFOSR-TR-60-90.
Order from LC mi$3.60, ph$9.30 PB 150 633

The first part of the report summarizes the aims and accomplishments of the research carried out over the entire period of the contract. The last part of this report outlines the research progress made since Technical Note TN 60-61. This latter material is covered under the following four headings: (a) natural spectra of ferrite powders, (b) ferrimagnetic resonance in magnetite spheres with either domain structure or with twinning, (c) induced spectra of γ-Fe_2O_3 powders and (d) ferromagnetic resonance in thin permalloy films.

National Bureau of Standards, Washington, D. C.
ON THE NATURE OF THE CRYSTAL FIELD APPROXIMATION, by Henry Goldberg (Doctoral thesis, U. of Maryland) and Charles Herzfeld. Oct 60, 100p. 22 refs. Technical note 67.
Order from OTS $2.25 PB 161 568

A new method is developed for the treatment of molecular interactions, and is applied to a system consisting of a hydrogen atom in a 2p state and a hydrogen molecule in the ground state. The interaction of these two species is calculated using ordinary crystal field theory and also the new method. A comparison of the results shows some of the shortcomings of the conventional crystal field theory, and provides corrections to it. The new method consists of (1) expanding all electron terms of the total Hamiltonian for the system which involves interactions between the atom and the molecule, thus transforming the interaction Hamiltonian into sums of products of one-electron operators, and (2) of using properly antisymmetrized wave functions made up of products of atom and molecule eigenfunctions. The calculations show the effect of the neglect of overlap and exchange in ordinary crystal field theory. All calculations and results are presented in full detail. Transformations of three-center to two-center integrals are given explicitly. (Author)

New York State Coll. of Ceramics, Alfred U.
SEMICONDUCTING MATERIALS, by T. J. Gray. Annual rept. Dec 58-Nov 59, on Contract Nonr-1503(01) [1960] 70p. 60 refs. AD-229 943.
Order from LC mi$3.90, ph$10.80 PB 150 537

A number of single crystal and polycrystalline samples refused to respond in the test unit during photoconductivity. When the minority carrier concentration in an extrinsic material is increased temporarily above its equilibrium value, its return will be by first order kinetic decay. The recombination rate in an illuminated sample increases above the norm as the hole and electron concentrations increase. Recombinations usually occur at centers deep in the forbidden band. The decay and the presence of centers can be studied by thermal glo-curves and by pulse illumination. Lifetimes are particularly sensitive to number of surface states, the surface treatment, and sample history. The major difficulty encountered in making d.c. Hall measurements on hot-pressed specimens seem to be a lack of uniformity in the specimens. Preliminary magnetoresistance values indicate a very small contribution from a hot-pressed sample. The addition of both d.c. and a.c. amplifiers should help to solve the sensitivity problem. The activation energy of a single crystal measured in a thermoelectric rig was normal, but the hot-pressed value was distinctly low. The slight deviation from linearity of this plot is possibly connected with the channeling problem, as this is a duplicate sample to the one used for Hall measurements.

New York U., N. Y.
PARAMAGNETIC RESONANCE IN THE SOLID STATE, by Hartmut Kallmann. Quarterly rept. no. 7, Jan-Mar 60, on Contract DA 36-039-sc-78056. May 60, 8p. 1 ref. AD-238 346.
Order from LC mi$1.80, ph$1.80 PB 150 443

Measurements of the number of free radicals produced by X-ray irradiation of solutions containing various percentages of benzene and carbontetrachloride are described. The solutions contain 10^{-3} mole diphenylpicrylhydrazyl (DPPH) as scavenger. The disappearance of the DPPH is measured in an EPR spectrometer. The amount of DPPH consumed is a measure of free radicals produced. Measurements with various X-ray doses show that the DPPH consumed and thus the free radicals formed are proportional to the dose. Measurements of Q and monitoring the power input to the sample cavity are planned to improve methods of comparing spin concentrations in different samples. (Author) (See also PB 147 931)

Ohio State U. Research Foundation, Columbus.
PHOSPHORUS DIFFUSION INTO SILICON THROUGH AN OXIDE LAYER, by Dawon Kahng and M. O. Thurston. Quarterly technical rept. no. 1, 1 Jan-31 Mar 59, on Research on Diffusion of Impurities into Silicon Through an Oxide Layer, Contract DA 36-039-sc-83874. May 59, 66p. 21 refs. Rept. 896-1; AD-218 842.
Order from LC mi$3.90, ph$10.80 PB 152 185

This report released for sale to the public 10 Nov 60.

The oxidation of silicon and the solid-state diffusion of phosphorus into silicon under oxidizing conditions have been studied theoretically and experimentally. It is shown that the mechanism of oxide growth on silicon depends upon the type of oxidizing atmosphere. In air the oxide grows at its outer surface, while in steam the growth occurs at the oxide-silicon interface. Solutions of the diffusion equation for various oxide-silicon systems of interest are presented. It is shown that for a diffusion begun with an oxide-free sample, the surface concentration of phosphorus on the silicon is independent of diffusion time. A simple formula is given for predicting how long a preoxidized sample of p-type silicon may be diffused at a given temperature before the surface will be converted. The experimental value of the diffusivity of phosphorus in SiO_2 is 10^{-14} cm^2 sec^{-1} at 1250°C; measured values at other temperatures are also given. (Author)

Pacific Semiconductors, Inc., Culver City, Calif.
STUDY OF SURFACES IN SEMICONDUCTOR DEVICES, by T. C. Hall. Quarterly technical rept. no. 2, 15 Sep-15 Dec 48, on Contract DA 36-039-sc-78049. [1958] 23p. 1 ref. PSI rept. no. 3000:21-2-Q.
Order from LC mi$2.70, ph$4.80 PB 150 811

The results of a 1000 hour continuing reliability study consisting of room temperature power aging on a group of eight silicon diffused junction diode structures protected by a thick chemically bonded polysiloxane layer are presented. Relative constancy of reverse breakdown and saturation current after initial stabilization is reported. Varying degrees of passivation of silicon diode crystal surfaces is produced by esterification of the surface oxide layer by exposure of the surface to alcohol and moist triethoxysilane vapor in separate experiments carried out in autoclave at elevated pressures and temperatures. Sensitivity of electrical characteristics on exposure to 0-100% relative humidity varied with autoclaving conditions. (Author)

Pacific Semiconductors, Inc., Culver City, Calif.
STUDY OF SURFACES IN SEMICONDUCTOR DEVICES, by T. C. Hall. Quarterly technical rept. no. 3, 15 Dec 58-15 Mar 59, on Contract DA 36-039-sc-78049. [1959] 20p. 1 ref. PSI rept. no. 3000:21-3-Q.
Order from LC mi$2.40, ph$3.30 PB 150 812

Thickened oxide films generated by either chemical or thermal methods on silicon p-n bar diodes have various effects on diode electrical characteristics under dry ambients. These effects are dependent upon the specific technique employed in the film formation. Such films provide limited protection against high humidity ambients over extended periods of time. Alcohol esterification of such oxide films on diodes under study causes no deterioration of electrical characteristics beyond that which may have been produced by the prior oxidation process itself. The retention of the initial junction electrical characteristics in ambient humidity is observed on esterified-oxide-protected junctions. Application of this information to the solution of problems of device reliability appears promising. (Author) (See also PB 150 811)

Pennsylvania U. School of Metallurgical Engineering, Philadelphia.
THE FRICTIONAL STRESS ACTING ON A MOVING DISLOCATION IN AN OTHERWISE PERFECT CRYSTAL, by Doris Kuhlmann-Wilsdorf. Rept. on Contract AF 49(638)435. July 60, 33p. 16 refs. [AFOSR] TN-60-978.
Order from LC mi$3.00, ph$6.30 PB 150 651

The problem of the frictional stress suffered by moving dislocations in otherwise perfect crystals is investigated. This is done without calculating the core energies of dislocations, but by considering stresses and strains on the slip plane. The level of frictional stresses obtained is much higher than reported previously. Since common glide dislocations in metals with close packed structures apparently do not suffer significant frictional stresses, mechanisms are discussed which tend to reduce their effect. A new such mechanism is discovered. It is based on the idea that the positions of dislocation axes are not defined with precision, but only within one to a few times the average displacement of the oscillating atoms. The expected results of this, is a depression of the frictional stress for close packed metals even at very low temperatures, almost no effect on dislocations in crystals with diamond structures, and a temperature dependence proportional to $e^{-\text{const } T/T_M}$ for NaCl type salts and, probably, for b.c.c. metals. (Author)

Rice U., Houston, Tex.
STACKING FAULTS IN PLATINUM, by J. Taranto and Franz R. Brotzen. Technical rept. no. 3 on Contract AF 49(638)78. July 60, 20p. 17 refs. AFOSR TN-60-882
Order from LC mi$2.40, ph$3.30 PB 150 749

The shift of X-ray diffraction lines was observed at various stages of recovery in filed powder specimens of platinum. As the line shift is a criterion of the change in stacking-fault probability, the disappearance of stack faults during annealing could be followed in an approximate manner. The activation energy of the annihilation process was estimated to be 28.8 ± 5 kcal/mol. (Author).

Stanford Electronics Labs., Stanford U., Calif.
STUDY OF SEMICONDUCTOR DEVICES BY ANALOGUE TECHNIQUES, by R. Bharat. Rept. on Contract Nonr-225(24). 16 Nov 59, 91p. 16 refs. Technical rept. no. 1502-1; AD-229 532.
Order from LC mi$5.40, ph$15.30 PB 150 525

Analogue techniques are applied to the study of semiconductor devices in pulse circuits, enabling one to make a transient analysis of models which describe both the internal and the terminal behavior of the devices. Physical phenomena in semiconductor devices are described in terms of lumped models and an analogue computer is set up to simulate the equations derived from these models. Equations relating the variables in the model of the device to the variables describing the circuit in which the device is operating are also simulated on the computer, and transient solutions are obtained for all the variables. Computer and electric-circuit analogues of several physical phenomena frequently encountered in semiconductor devices are developed. Both linear and nonlinear phenomena are considered and various methods of simulating them are described. Analogue computer solutions are obtained for transistor pulse circuits in which interacting nonlinear phenomena influence the operation of the circuit. Solutions for a drift-transistor switching circuit and for an avalanche-transistor relaxation-oscillator circuit are presented. (Author)

Uppsala U. (Sweden).
BORIDES AND SILICIDES OF THE TRANSITION METALS, by Bertil Aronsson. Technical note no. 13 on Contract AF 61(052)40. 1 July 60, 114p. 197 refs. AFOSR-TN-60-683.
Order from OTS $2.50 PB 171 121

Contents:
A survey of intermediate phases in Me-B, Me-Si, and Me-Si-B systems and their crystallographic constants
Borides
Silicides
Silico-borides
Physical and chemical properties of borides and silicides. Some general features of Me_1-M_2-X, Me-B-X and Me-Si-X ternary systems (X=B, Si, C, N)
Some features of the crystal chemistry of borides and silicides
The solid solubility of boron and silicon in metals
Structures of phases containing less than 33 atom per cent non-metal
Structures of phases containing 33-40 atom per cent non-metal
Structures of phases containing 40-50 atom per cent non-metal
Structures of phases containing 50-75 atom per cent non-metal
Structures of phases containing more than 75 atom per cent non-metal
Concluding remarks
A brief comment on the similarities between the properties of silicides, borides, carbides and nitrides and on the 'bonding' in these phases
(See also PB 142 971)

Theoretical Physics

Avco-Everett Research Lab., Mass.
AN ARC TUNNEL FOR MAGNETOHYDRODYNAMIC STUDIES, by Richard Rosa. Rept. on Contract AF 04(647)278. June 59, 13p. 12 refs. Research note 132; AFBMD-TN-59-6; AD-227 863.
Order from LC mi$2.40, ph$3.30 PB 152 678

This report released for sale to the public 16 Nov 60.

An arc wind tunnel or plasma jet can be used to produce a steady gas flow over a considerable range of temperature, pressure, and gas composition. In particular, it can produce gas temperatures sufficient for appreciable thermal ionization to occur, especially if the gas is seeded with a small amount (1% or less) or alkali metal vapor. For this reason it should be a useful tool for magnetohydrodynamic (MHD) studies. A discussion is presented of a tunnel developed for this purpose, specifically for studies related to MHD acceleration of and power generation from a conducting gas stream. The design criteria for such a facility

are discussed. A magnet for use with this tunnel was also built and some first results of efforts to generate electric power from the interaction of the hot gas stream and the magnetic field are described. (Author)

Electron Tube and Microwave Lab., Calif. Inst. of Tech., Pasadena.
PLASMA INTERACTION RESEARCH PROJECT, by R. W. Gould and D. G. Dow. Quarterly progress rept. no. 4 (Final) 1 Dec 58-30 Nov 59, on Contract DA 36-039-sc-78230. [1959] 28p. 12 refs. AD-239 994.
Order from LC mi$2.70, ph$4.80 PB 150 447

Detailed studies are under way concerning the feasibility of the cyclotron orbit oscillator described in previous reports. The effect of a non-uniform plasma, and the degree of non-uniformity to be expected are considered theoretically. A modification of the Phillips Ion Gauge (PIG) discharge is being investigated for possible generation of millimeter wavelength plasmas. A partial explanation for the multiple scattering peaks seen in the reflection of an electromagnetic wave from a plasma column was worked out, and the discrepancies between the experiment and theory may be explainable on the basis of density variations in the plasma.

Maryland U., College Park.
DEMONSTRATION OF QUANTUM MECHANICS IN THE LARGE, by T. B. Day. Sep 60, 12p. 7 refs. Dept. of Physics Technical rept. no. 195.
Order from LC mi$2.40, ph$3.30 PB 150 891

Maryland U., College Park.
LIE EQUATIONS FOR A LEE MODEL, by E. R. Caianiello and S. Okubo (U. of Naples). Rept. on Contract AF 49(638)24 and Technical rept. no. 12 on Contract DA 91-591-EUC-1096. July 60, 21p. 2 refs. Physics Dept. Technical rept. no. 185a; [AFOSR] TN-60-898; AD-242 656.
Order from LC mi$2.70, ph$4.80 PB 150 557

The renormalization in configuration space of a slight generalization of the Lee model is discussed, as an example of general procedures which seem to be applicable also to more general cases than the present one. The replacement of ordinary with finite-part integrals removes consistently all ultraviolet infinities and permits to write the Lie equations of the renormalization group, the solution of which yields the familiar relations between unrenormalized and renormalized parameters. (Author)

Maryland U., College Park.
A NEW REDUCTION TECHNIQUE IN QUANTUM FIELD THEORY, by John S. Toll. Rept. on Contract AF 49(638)24. Aug 60, 24p. 12 refs. Physics Dept. Technical rept. no. 194; [AFOSR] TN-60-1089; AD-243 376.
Order from LC mi$2.70, ph$4.80 PB 150 969

A new technique is presented for reduction of the scattering matrix or other physical quantities in quantum field theory. These quantities are expressed as integrals involving vacuum expectation values of products of field variables. The procedure is similar to that of Lehmann, Symanzik and Zimmermann but differs from LSZ by the explicit introduction of functions which vanish outside the future light cone. The new techniques is more cumbersome than the LSZ method and inferior to it for many applications but has the advantage of yielding a larger primitive domain of analyticity and of not requiring local commutativity nor any other form of causality assumption beyond those requirements that are implicit in the modified asymptotic condition. The method is illustrated for the case of two particle scattering and for the vertex function. It has been checked in simple cases of examples in perturbation theory in lowest order. It is shown that, without additional assumptions, the Reduction technique has only trivial consequences, for it is proved that any matrix element can be chosen as an arbitrary invariant function of the energies and momentum transfers involved and that it can still be extended off the mass shell to satisfy the analyticity and mass spectrum conditions. Thus, useful restrictions involving only quantities at points of direct physical meaning have not yet been obtained; to gain such restrictions, the unitarity condition or some explicit form of causality assumption would be required. (Author)

Maryland U., College Park.
REGULARIZATION AND RENORMALIZATION THROUGH FINITE-PART INTEGRALS, by E. R. Caianiello and A. Campolattaro and B. Preziosi (U. of Naples). Rept. on Contract AF 49(638)24 and Technical rept. no. 11 on Contract DA 91-591-EUC-1096. June 60, 33p. 11 refs. Physics Dept. Technical rept. no. 182. [AFOSR] TN-60-762; AD-242 655.
Order from LC mi$3.00, ph$6.30 PB 150 556

The replacement of ordinary with finite-part integrals, which generalize the definition originally given by J. Hadamard, was shown previously to yield ipso facto correctly renormalized field equations independently of perturbative techniques, provided due care is taken of the symmetry properties of the theory and some quantitative conditions (closely related to Dyson's heuristic conditions for renormalizability) are satisfied by the theory itself. In this work we extend the class of finite-part integrals considered before to cover all instances which may practically occur and discuss several possible prescriptions in configuration space which exhibit the wanted properties. It appears that some prescriptions are better suited to the study of general questions, such as renormalizability of a theory and deduction of the Lie equations of its renormalization group, while others are more convenient for actual computation, once renormalizability is proved. This work will be followed shortly by another in which this method will be shown to yield the expected results in the case of the Lee model. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
RESEARCH IN A COMPREHENSIVE THEORY OF PLASMA STATES AND PHENOMENA. Final rept. (Part 4) on Contract AF 33(616)5693. Mar 60, 80p. 6 refs. Technical rept. no. 441; WADD Technical rept. 59-486; pt. 4; AD-239 876.
Order from LC mi$4.50, ph$12.30 PB 147 780-4

The analysis indicated that a plasma, except at very high pressures, can be considered as a nearly perfect

gas. The departure may lead to a correction which is usually 10% or less. Further, the correction term can be approximated to a good accuracy by means of the Debye-Huckel theory. The effects of magnetizing the plasma are shown to influence the transport properties by altering the effective collision frequency. Finally, it is shown that the coupling between a moving fluid and a magnetic field is reduced by the changes in transport properties produced by the magnetic field. The recommendation was made that one of the primary research efforts in plasma physics be that of measuring the transport properties under a variety of circumstances. (Author) (See also PB 147 780-3)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
MAGNETOHYDRODYNAMICS. Aug 60, 8p. 122 refs. OTS Selective Bibliography SB-426.
Order from OTS $0.10 OTS SB-426

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. This bibliography includes reports added to the OTS collection during the period 1950 to September 1960.

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
DYNAMIC STABILIZATION OF A PLASMA COLUMN, by Erich S. Weibel. 15 Aug 60, 63p. 21 refs. STL/TR-60-0000-GR269.
Order from LC mi$3.90, ph$10.80 PB 152 113

A cylindrical plasma column is confined by a magnetic field whose z-component is constant while the ψ-component oscillates sinusoidally. The skin depth is assumed to be negligible so that the boundary can be considered as sharp and the interior of the plasma as field free. The plasma itself is treated as an assembly of non-colliding particles which are specularly reflected at the plasma surface. The oscillating pressure of the applied field causes the plasma surface to execute a small periodic motion independent of ψ and z. All other components of the displacement decay in time. Thus, the plasma is positively stable against all deformations. For magnetostatic confinement this treatment yields the usual instabilities, but in contrast to earlier work, the growth rates are bounded as the deformation wave length approaches zero. This appears to be in better agreement with experiment. (Author).

Plasma Propulsion Lab., Republic Aviation Corp., Farmingdale, N. Y.
PINCH DYNAMICS WITH NONUNIFORM INITIAL CONDITIONS, by William J. Guman and Irving Granet. Rept. on Contract Nonr-2851(00). Jan 60, 24p. PPL-TR-60-6; AD-237 560.
Order from LC mi$2.70, ph$4.80 PB 147 838

The basic equations of the "snow plow" pinch analysis are formulated in a constant area electrode geometry for the case of a pinch occurring in a fluid having initial velocity and density distributions. The geometry selected readily converts radial pinch motion to an axial motion. This new formulation can be applied to the case of uniform initial conditions and also to a different approach to the slug model which accounts for the internal energy in the fluid. (Author)

Sperry Gyroscope Co., Great Neck, N. Y.
A BEAM-GENERATED BEAM-PLASMA SYSTEM, by C. C. Wang, J. E. Hopson and L. P. Levine. Final rept. for 1 Apr 59-31 Mar 60 on Contract AF 19(604)5555. May 60, 40p. 2 refs. Sperry rept. no. NA-8210-8199; AFCRC-TR-60-163.
Order from LC mi$3.00, ph$6.30 PB 150 991

The minimum pressure condition for plasma generation, the result of directing an electron beam through a residual gas (hydrogen in this study) along magnetic field lines, has been theoretically predicted and experimentally verified. For pressures greater than the minimum pressure, the equilibrium plasma density has been analyzed. Plasma growth greater than that expected from collisions of primary electrons with residual gas atoms was found; diffusion-controlled breakdown caused by a microwave generation process of the system explains this growth. Microwave interaction of the beam-generated plasma circuit with the primary beam is exhibited as a velocity modulation of the beam. Experiments show a discrete bandwidth noise spectrum; theoretically, discrete frequency oscillations over a prescribed bandwidth should be produced. Plasma circuit characteristics are not independent of microwave power level as assumed in the theory; the microwave power generated is apparently absorbed by the plasma. The plasma, then, is unstable. Objectives have been attained in the experimental and theoretical studies of the generation of a plasma by an electron beam, and the beam generated plasma as an electromagnetic circuit for interaction with the same electron beam. (Author). (See also PB 148 316).

Sperry Gyroscope Co., Great Neck, N. Y.
ELECTROMAGNETIC WAVE PROPAGATION IN GYROELECTRIC PLASMAS, by C. C. Wang and J. E. Hopson. Scientific rept. no. 2 on Contract AF 19(604)5555. May 60, 79p. 10 refs. Sperry rept. no. NA-8210-8191-2; AFCRC-TN-60-596.
Order from LC mi$4.50, ph$12.30 PB 150 629

A detailed theoretical analysis of electromagnetic wave propagation in a uniform plasma immersed in a uniform, externally-superimposed magnetic field is presented. The assumed plasma model is a uniform distribution of free, noncolliding charged particles of zero temperature and with an average net charge of zero. The possibility of interaction between electromagnetic waves in plasma circuits and directed electron beams is of particular interest. The Maxwell equations and boundary conditions for the assumed plasma model are developed, and the general phase characteristics of plane waves in an infinite plasma are discussed. It is shown, by solution of the Maxwell equations for general wave propagation along an externally-superimposed magnetic field, that it is in general impossible to separate TE and TM modes except at cutoff. The general, exact theory developed is applied to the problem of a circular waveguide filled with a uniform plasma and having a magnetic field directed along the symmetry axis. The method is also applicable to other problems involving propagation along the externally-superimposed magnetic field. (Author)

University of Southern California. Engineering Center, Los Angeles.
MICROWAVE MEASUREMENT OF ELECTRON DENSITY DISTRIBUTIONS IN PLASMA COLUMNS, by Gordon E. Stewart and Zohrab A. Kaprielian. Technical note on Contract AF 49(638)522. 29 July 60, 45p. USCEC rept. 79-201; AFOSR-TN-60-927; AD-243 530.
Order from LC mi$3.30, ph$7.80 PB 150 988

Numerous applications of the arc discharge tube in the study of plasmas require some knowledge of the electron density as a function of position in the tube. In general, the region of the discharge called the "positive column" is used for studying the properties of this plasma. In the positive column the electron density is independent of axial or longtitudinal coordinates, but does vary with the radius. It is the objective of this paper to describe a method for explicitly representing the radial dependence of the density in terms of a series of orthogonal polynomials of the radius, the coefficients of which are evaluated by the shift in frequency of resonance of microwave cavity modes. (Author)

University of Southern California. Engineering Center, Los Angeles.
RADIATION FROM A GAP-EXCITED CYLINDER SURROUNDED BY A UNIFORM PLASMA SHEATH, by Hans H. Kuehl. Rept. on Contract AF 19(604)5722. 30 June 60, 19p. 2 refs. USCEC rept. 71-202; ERD TN-60-785.
Order from LC mi$2.40, ph$3.30 PB 150 734

The far-zone electromagnetic radiation from a long, gap-excited, perfectly conducting cylinder surrounded by a uniform plasma sheath, is derived. The gap is taken to be very narrow in the axial direction and encircles the cylinder; the impressed electric field in the gap is in the axial direction. A general integral expression for the far-zone radiation is presented for arbitrary cylinder lengths and the exciting gap not necessarily in the midplane of the cylinder. For the case of infinite cylinder length, the integral can be easily evaluated; this result being the zero-order approximation to the finite length cylinder. Radiation patterns for the infinite cylinder of small radius and sheath thickness are presented for various values of the plasma frequency. (Author)

Western Reserve U., Cleveland, Ohio.
THE INTERNAL STATE OF A GRAVITATING GAS, by G. E. Tauber and J. W. Weinberg. Technical rept. for 1 June 58-10 Dec 59 on Contract Nonr-1439(05). 10 Dec 59, 77p. 22 refs. AD-237 969.
Order from LC mi$4.50, ph$12.30 PB 147 908

The significance of a theory of gravitational equilibrium of concentrated masses is discussed in connection with possible general relativistic effects in white dwarf stars. The covariant form of phase space and Liouville's theorem is developed, using the canonical equations for a particle under gravitational and electromagnetic forces. The dynamical isotropy of the ideal fluid is formulated, and the associated equations of state and allowed streaming patterns are found. A covariant kinetic theory yields general relativistic forms for the Maxwell and Fermi distributions in the case of thermal equilibrium, and limits their streaming to rigid motion. Rotating fluids are studied in comoving coordinates, and the problem of determining their gravitational equilibrium is reduced, in most cases of physical interest, to a simple standard form with constant density and vorticity. (Author)

Thermodynamics

Avco-Everett Research Lab., Mass.
CONTINUUM INFRARED SPECTRUM OF HIGH TEMPERATURE AIR, by Raymond L. Taylor. Rept. on Contract DA 19-020-ORD-4862. June 60, 19p. 14 refs. Research rept. 88.
Order from LC mi$2.40, ph$3.30 PB 150 955

It has been possible to measure the absolute intensity of infrared radiation from air shock heated to an equilibrium temperature of 8000°K and nearly atmospheric density over the wavelength range of 2 - 6.5 μ. The continuum radiation is due primarily to free-free scattering of electrons by atoms and molecules. The general level of intensity, but not the wavelength dependence, is predicted by a calculation of the Kramer's radiation using a coulombic field of effective nuclear charge, Z = 0.15. The temperature dependence of this radiation measured at 2.35 μ and 3.88 μ over the range of 6000-8000°K is found to follow the temperature dependence curve appears around 3.6 - 4.0 μ. The origin of a band system in this region is not known, although it would appear to involve an electron collision process. (Author)

Brown U. Div. of Engineering, Providence, R. I.
STEADY-STATE THERMAL STRESSES IN AN ELASTIC CONE, by Rokuro Muki and Eli Sternberg. Technical rept. no. 14 on Contract Nonr-562(20) and Rept. on Contract Nonr-562(25). Nov 59, 41p. 21 refs. Nonr 562(20)/14; AD-229 493.
Order from LC mi$3.30, ph$7.80 PB 150 474

A determination was made of the steady-state thermal stresses generated in an elastic circular cone of semi-infinite extent by a discontinuous distribution of the prescribed surface temperature. Specifically, the surface of the cone is exposed to a constant temperature up to a given distance from the vertex, the remainder of the boundary being maintained at a distinct uniform temperature. A solution to the associated thermoelastic problem is established in real integral form. This solution, which is exact within the classical theory of elasticity, is deduced with the aid of the Mellin transform. Illustrative numerical results are presented for the thermal stresses along the axis and at the surface of the cone, corresponding to an opening angle of 60°. The scheme of analysis employed in connection with the current thermoelastic investigation is adaptable to an explicit treatment of ordinary elastostatic boundary-value problems for a cone subjected to piecewise continuous surface loads. (Author).

Convair, Pomona, Calif.
THERMAL STRESSES IN A PERFORATED SQUARE PLATE, by R. D. Sutherland and S. M. Manville. Rept. on Contract AF 49(638)592. June 60, 39p. 5 refs. TM-349-19; AFOSR TN-60-840; AD-242 797.
Order from LC mi$3.00, ph$6.30 PB 150 738

The thermal stress problem in a square plate containing a central circular hole is solved using the complex analysis of Muskhelishvili and conformal mapping. A temperature distribution for this configuration is observed experimentally. This distribution is used in conjunction with the results of the analysis to calculate the thermal stresses in the plate. The stresses thus obtained are presented as functions of radial and angular displacement throughout the plate. (Author).

Duke U. [Durham, N. C.]
A CLASS OF SOLUTIONS OF THE EQUATIONS OF THERMOELASTIC EQUILIBRIUM, by Ian N. Sneddon. Rept. on Contract AF 18(600)1341. Aug 60, 11p. 9 refs. AFOSR-TN-60-1046; AD-243 176.
Order from LC mi$2.40, ph$3.30 PB 152 068

In this paper a solution is given of the equations of thermoelastic equilibrium appropriate to problems in which the conditions

$$\tau_{xz} = \tau_{yz} = 0, \quad \text{on } z = 0,$$

are imposed. It is not assumed that the normal component of stress σ_z is also zero.

Institute of Engineering Research, U. of California, Berkeley.
THE INFLUENCE OF HYDROGEN RECOMBINATION ON TURBULENT FLOW HEAT TRANSFER TO A FLAT PLATE, by L. L. Cobb, Jr. Master's thesis. Rept. on Contract DA 04-200-ORD-776. 1 June 60, 44p. 15 refs. Rept. no. HE-150-183; Series no. 128, issue no. 5.
Order from LC mi$3.30, ph$7.80 PB 150 762

A previous study of the heating characteristics of an oxygen-acetylene flame apparatus for surface ablation studies showed a large difference between measured heating rates and those predicted by convection heat transfer theory. Since atomic hydrogen was present in the flame, it was postulated that the exothermic recombination of these atoms was responsible for the increased energy transfer. The present investigation was undertaken to study this possibility. A discussion of convection heat transfer in dissociated gas systems is presented. Experimental measurements were made to verify the magnitude of the total heat flux and to establish the recombination mechanism. The experimental measurements verified the flux magnitudes predicted by the theory; volume recombination was established as the process responsible for the recombination reaction.

Massachusetts Inst. of Tech., Cambridge.
AN EXPERIMENTAL APPROACH TO THE DETERMINATION OF GASEOUS TRANSPORT PROPERTIES AT VERY HIGH TEMPERATURES, by I. Amdur. Technical rept. no. 4 on Contract Nonr-1841(23). 30 Nov 59, 21p. 24 refs. AD-230 116.
Order from LC mi$2.70, ph$4.80 PB 150 486

Values of gaseous transport properties at elevated temperatures may be calculated from appropriate kinetic theory relations (or from statistical mechanics if equilibrium properties are of interest) provided that the correct intermolecular potential functions are known. It is pointed out that the potentials for this purpose may not be extrapolations of functions which are valid only for relatively large distances of separation, and therefore suitable only for calculation of low temperature properties, but must be ones which are valid at the smaller distances of separation of importance at elevated temperatures. The experimental procedure is described for determining such potentials from elastic scattering of neutral beam particles having kinetic energies of the order of 1000 ev. It is shown that meaningful potential energy information cannot be deduced from such experiments unless the shape and intensity distribution of the beam, as well as the geometry of the beam-detector system are taken into account. Results are tabulated for the potentials of a number of atom-atom and atom-molecule systems and a procedure for obtaining molecule-molecule interactions for such results is indicated. (Author)

Massachusetts Inst. of Tech., Cambridge.
IONIZATION IN SEEDED DETONATION WAVES, by Satyaki Basu. Rept. on Project Squid, Contract Nonr-1858(25). Nov 59, 30p. 18 refs. Technical rept. MIT-22-P; AD-229 112.
Order from LC mi$2.70, ph$4.80 PB 150 532

An investigation was made of equimolal oxy-C_2H_2 detonations at 1/10 atm initial pressure, which were seeded with C_2HK to obtain good conductivity. Finely ground C_2HK was injected into the initial mixture. Conductivity was determined by a magnetohydrodynamic interaction method developed by Lin (J. Appl. Phys. 26:95, 1955). Measured conductivities were compared with the results of thermodynamic equilibrium calculations, which included the cooling effect due to the heat capacity of the additive. Theoretical and measured conductivities agreed within a factor of 2, the agreement improving with increasing mole fraction of K. An electron-gas cross section of 2.5×10^{-15} cm^2 agreed with theory and experiment.

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
SUPERFAST PINCH STUDIES, by Lee O. Heflinger and Stanley L. Leonard. Rept. on Thermonuclear Propulsion Research, Contract AF 04(647)309. Aug 60, 64p. 16 refs. STL/TR-60-0000-09226.
Order from LC mi$3.90, ph$10.80 PB 150 890

An apparatus designed to accelerate protons of a hydrogen plasma to energies of 1 kev or more by means of the radially converging magnetic piston of a longitudinal pinch has been constructed. A capacitor charged to voltages of up to 300 kv is discharged through the plasma, producing currents of up to 75 ka. The ringing frequency is 18mc, so that the rate of current rise is about 0.8×10^{13} amp/sec. Radially converging luminous fronts with maximum velocities in excess of 50 cm/μsec are observed and are interpreted as shock waves driven by a magnetic piston. Magnetic probe measurements and measurements of the electric field at the wall of the discharge tube show that much of the magnetic flux intro-

duced during the first half cycle is trapped in the hot plasma. The effects of varying such parameters as the total current, the initial pressure of the gas, the type of gas, and the frequency of the discharge have been investigated. The experimental results are interpreted in terms of the classical Rosenbluth-Garwin theory of the pinch, which seems to correlate well with the observations. (Author).

Wave Propagation

Air Force Cambridge Research Labs., Cambridge, Mass.
BACK SCATTERING FROM CONDUCTING SURFACES, by Roy C. Spencer. Apr 51, 18p. 7 refs. E5070.
Order from LC mi$2.40, ph$3.30 PB 152 616

This report released for sale to the public 16 Nov 60.

Three methods of analysis are discussed: (1) Geometric Optics. The mean back scattering cross section $\bar{\sigma}$ for all orientations of a smooth, convex closed surface is $\bar{A} = S/4$ where $\bar{A}$ is the mean shadow area of the surface and S is the total surface. Any particular σ is given by $\pi R_1 R_2$ where R_1 and R_2 are the principal radii of curvature at the point of incidence. (2) Physical Optics. This neglects polarization and leads to $\sigma = (4\pi g^2)/\lambda^2$ where g is the effective flat-plate area of the surface and is usually approximated by $1/\pi$ times the area of the first Fresnel zone (area cut by the plane wave a distance $\lambda/4$ beyond the point of incidence). (3) Electromagnetic Theory. With certain simplifying assumptions, there is no depolarization. Again, $\sigma = (4\pi g^2)/\lambda^2$ where $g = \int e^{2ikp}\, dA$. The method is applied to (a) the inclined rectangular plate and (b) surfaces of revolution observed end-on, including spheres, ellipsoids and cones. The tapered cone has a value of $\sigma = (\lambda^2/16\pi)\tan^4\theta$ where θ is the angle between the axis and the conical elements at the tip. This value increases slowly as the cone is tilted. The validity of the assumptions is to be questioned in such cases of extremely small values of σ. (Author)

Bolt Beranek and Newman, Inc., Cambridge, Mass.
INPUT IMPEDANCES OF SIMPLE CYLINDRICAL STRUCTURES, by Peter A. Franken. Rept. on Contract Nonr-2322(00). 10 Nov 59, 22p. 3 refs. Rept. no. 690.
Order from LC mi$2.70, ph$4.80 PB 150 879

A thin cylindrical shell driven in vacuum below its radial resonance may be described by membrane theory. Each non-axisymmetric modal impedance contains a resistance and a mass of equal magnitude, as in the case of an infinite bar. The impedance decreases with increasing mode number up to a "cutoff" mode, and stiffness effects become important for modes above the cutoff mode. The analysis includes finite shells and rings. (Author).

Brown U. Div. of Engineering, Providence, R. I.
PULSE DIFFRACTION BY AN IMPERFECTLY REFLECTING WEDGE, by V. M. Papadopoulos. Scientific rept. no. 8 on Research Directed Toward the Study of Radiation of Electromagnetic Waves, Contracts AF 19(604)4561 and Nonr-562(24). June 60, 16p. 15 refs. Scientific rept. AF 4561/8; AFCRC TN-60-597.
Order from LC mi$2.40, ph$3.30 PB 152 059

A similarity method is used to develop a solution of the wave equation within a sector with mixed boundary conditions. In this manner the field which results from the diffraction of an incident pulse of step function time dependence is found. (Author)

Centro Radioelettrico Sperimentale "G. Marconi", Rome [Italy].
TROPOSPHERIC INFLUENCE ON H. F. BACKSCATTER NEAR THE SEA, by I. Ranzi. Scientific note no. 2 on Contract AF 61(052)139. 30 Mar 60, 7p. 1 ref. AFCRL-TN-60-953.
Order from LC mi$1.80, ph$1.80 PB 160 650

Very intense echoes backscattered from mountains near the coastal boundary at distances up to 100 km and more are observed on frequencies between 3 and 7 Mc/s. The intensity of the echoes shows a diurnal variation with a midday maximum and a day to day variation, apparently connected with the meteorological conditions. This behavior and the high value of the backscatter cross sections, resulting from the measurements, show that the backscatter mechanism for H. F. radio waves is strongly influenced by the tropospheric refraction. (Author).

Ionosphere Research Lab., Pennsylvania State U., University Park.
POLARIZATION OF VERTICALLY INCIDENT RADIO WAVES AT A FREQUENCY OF 300 KC/S, by J. M. Greene. Scientific rept. no. 137 on Ionospheric Research, Contract AF 19(604)4563 and National Science Foundation Grant G 5939. 15 Aug 60, 61p. 6 refs. AFCRL TN-60-645.
Order from LC mi$3.90, ph$10.80 PB 150 669

Instrumentation is described for the recording of polarization data on a frequency of 300 kc/s. Incident waves are resolved into their two circularly polarized components, the amplitudes of which are directly recorded by the equipment. Continuous polarization data of the main (90 km) echo have been scaled for the period November, 1959 to March, 1960 and averaged results are presented in tabular form. Samples of "high-echo" data (i.e., echoes observed at a height above the main echo) are presented and some of the more common phenomena are discussed in terms of the classic magneto-ionic theory. This theory is reviewed in some detail in one of the chapters. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
ATMOSPHERIC ABSORPTION OF 10-400 kMcps RADIATION: SUMMARY AND BIBLIOGRAPHY TO 1960, by E. S. Rosenblum. Rept. on Contract AF 19(604)5200. 15 Aug 60, 24p. 75 refs. 82G-0021.
Order from LC mi$2.70, ph$4.80 PB 150 507

This report attempts to summarize the presently available data on atmospheric absorption, and to explain the limitations of these data. Emphasis is placed herein on

absorption by normal molecular oxygen and water vapor; other contributing factors are considered only incidentally, if at all.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE STEWART AIR FORCE BASE TO NORTH TRURO TROPOSPHERIC-SCATTER COMMUNICATION SYSTEM by G. L. Mellen, D. H. Hamilton, Jr. and others. Rept. on Contract AF 19(122)458. 18 July 58, 24p. 7 refs. Technical rept. no. 183; AD-133 863.
Order from LC mi$2.70, ph$4.80 PB 150 610

The results of the operation of an experimental UHF tropospheric-scatter communication system suitable for Texas Tower to shore application are presented. The system provided 72 voice-telephone channels between terminals separated by more than 200 statute miles. Included are conclusions and recommendations for new design and operating criteria in future tropospheric-scatter systems. (Author)

Naples U. (Italy).
FURTHER EXPERIMENTS OF IONOSPHERIC SELF-MODULATION AT OBLIQUE INCIDENCE, by Mario Cutolo, Maria Cioffi and others. Scientific rept. no. 1 on Contract AF 61(514)1229. 5 Jan 60, 54p. 15 refs. AFCRC-TN-60-210.
Order from LC mi$3.60, ph$9.30 PB 150 928

National Bureau of Standards, Boulder, Colo.
QUARTERLY RADIO NOISE DATA, JUNE, JULY, AUGUST 1959, by W. Q. Crichlow, R. T. Disney, and M. A. Jenkins. 9 Sep 60, 65p. 11 refs. Technical note no. 18-3.
Order from OTS $1.00 PB 151 377-3

See also PB 151 377-2

National Bureau of Standards, Boulder, Colo.
QUARTERLY RADIO NOISE DATA, SEPTEMBER, OCTOBER, NOVEMBER 1959, by W. Q. Crichlow, R. T. Disney, and M. A. Jenkins. 28 Sep 60, 64p. 11 refs. Technical note no. 18-4.
Order from OTS $1.50 PB 151 377-4

See also PB 151 377-3

National Bureau of Standards, Boulder, Colo.
QUARTERLY RADIO NOISE DATA, DECEMBER, JANUARY, FEBRUARY 1959-60, by W. Q. Crichlow, R. T. Disney, and M. A. Jenkins. 10 Oct 60, 66p. 11 refs. Technical note no. 18-5.
Order from OTS $1.75 PB 151 377-5

See also PB 151 377-4

National Bureau of Standards, Boulder, Colo.
TABLE OF MAGNITUDE OF REFLECTION COEFFICIENT VERSUS RETURN LOSS ($L_R = 20 \log_{10} \frac{1}{|\Gamma|}$) by R. W. Beatty and W. J. Anson. 19 Sep 60, 47p. 3 refs. Technical note no. 72.
Order from OTS $1.25 PB 161 573

The following table yields values of r for a given value of R according to the relationship $R = 20 \log_{10} \frac{1}{r}$. The range and intervals of R are as follows: 0.0000 (0.0001) 0.0100, and 0.000 (0.001) 20.000. One can extend the use of the tables to higher values of R merely by shifting decimal points in an appropriate manner. The intervals are sufficiently small to permit convenient and accurate inverse interpolation. The seven significant figures given in the table are estimated to be correct except for an occasional error of one digit in the last place due to rounding.

Purdue Research Foundation, Lafayette, Ind.
THE SCATTERING OF A PLANE ELECTROMAGNETIC WAVE BY A FINITE CONE, by C. C. Rogers and F. V. Schultz. Scientific rept. no. 1 on Contract AF 19(604)4051. 1 Aug 60, 72p. 34 refs. ERD-TN-60-765.
Order from LC mi$4.50, ph$12.30 PB 150 874

This paper treats the solution of the vector Helmholtz equation for the case of a plane electromagnetic wave at 'nose-on' incidence on a perfectly-conducting cone of finite size. The solution presented is exact and in the form of an infinite series of spherical harmonics. The expansion coefficients of the series are determined by a set of an infinite number of equations involving an infinite number of unknowns. A discussion and numerical investigation of the field singularities at the tip and edge of the cone are included, as well as graphs of the associated Legendre functions of non-integral degree, P^1_ν (cos θ), and their first derivatives. (Author).

Technical Research Group, Syosset, N. Y.
SURVEY OF THE LITERATURE ON MILLIMETER AND SUBMILLIMETER WAVES, by Jerome Lurye. Scientific rept. no. 2 on Contract AF 19(604)4574, 30 June 60, 103p. 213 refs. TRG-127-SR-2; ERD-TN-60-762.
Order from LC mi$5.70, ph$16.80 PB 152 051

This report contains a survey of the literature on millimeter and submillimeter waves with emphasis on their application to the problem of communication between two high altitude hypersonic vehicles. The topics covered are sources and amplifiers, the effect of the ionized sheath, propagation phenomena, and (briefly) detectors. The survey is followed by a comprehensive bibliography of the subject. The bibliography covers the decade from 1950 through 1959; however, some earlier and some more recent references have been included. (Author).

University of Southern California. Engineering Center, Los Angeles.
A STUDY OF THE TRANSMISSION OF RADIO SIGNALS FROM A HYPERSONIC VEHICLE, by Raymond L. Chuan, Hans H. Kuehl, and Zohrab Kaprielian. Rept. on Contract AF 19(604)5722. 30 June 60, 32p. 9 refs. USCEC rept. 71-101; ERD-TR-60-176.
Order from LC mi$3.00, ph$6.30 PB 150 735

In order to acquire some understanding of the mechanisms whereby the propagation of an electromagnetic signal is affected by the pressure of a partially ionized gas layer (the "ion sheath") adjacent to a hypersonic

vehicle, a program of research combining theoretical and experimental efforts was initiated. The first year's tasks consisted of (1) the modification of a low density hypersonic wind tunnel to produce flows at Mach number 14 at an equivalent altitude of about 300,000 ft. and a velocity of about 15,000 ft./sec.; (2) a study of scaling parameters to render possible the extension of model studies to full-scale flight conditions; (3) theoretical studies of the effects of a uniform plasma sheath on the radiation of a finite cylinder; (4) determination of the electronic and aerodynamic configurations for the wind tunnel experiments; and (5) exploratory studies of the use of a microwave interferometer for the determination of electron density. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
INSTRUMENTATION FOR THE DETERMINATION OF PHOTOGRAPHIC IMAGE CORRELATION, by Donald F. Menne. June 60, 18p. Technical note no. 1315.
Order from LC mi$2.40. ph$3.30 PB 150 418

A description of instrumentation for correlating photographs of selected subjects is presented. The technique employs a parallel light beam which is intersected by a stationary photograph and a movable photograph. A comparator has been modified and adapted to transport the movable photograph on its stages and provide the facilities for measuring the displacement between the two photographs. Correlation is indicated by a photosensitive device which measures the amount of light passing through the photographs. Results from the correlation of a high contrast pattern illustrate the sensitivity and reproducibility of the measuring system. Samples of auto-correlation and cross-correlation of selected subjects are included. (Author)

Human Sciences Research, Inc., Arlington, Va.
METHODOLOGY FOR ANALYSIS OF MAN'S ROLE IN AN ADVANCED SPACE FLIGHT SYSTEM. A CASE STUDY IN SYSTEM RESEARCH METHODOLOGY, by Peter G. Nordlie. Rept. no. 5 on Contract Nonr-2525(00). Nov 59, 17p. 1 ref. HSR-RM-59/25-SM; AD-229 925.
Order from LC mi$2.40, ph$3.30 PB 150 838

The tasks described represent the logical sequence of steps taken to develop design requirements for the displays and controls of the space vehicle cockpit. The phase/function analysis resulted in a set of required functional activities, which were tentatively assigned to human and equipment components. These functional activities were translated into a set of required input and output parameters, which were in turn described on a time base in the SSOA (Second-by-second Operational Analysis). Results of the SSOA were summarized to provide indices of work load, link frequency, and use/frequency. These indices in turn helped to specify design (Research Methods, Techniques and Equipment, 13 Jan 60) requirements for the cockpit and for the displays and controls it contained. (Author)

Human Sciences Research, Inc., Arlington, Va.
METHODOLOGY FOR EVALUATION OF A MAN-MACHINE SURVEILLANCE SYSTEM, by John A. Whittenburg. Rept. #6 on Contract Nonr-2525(00). Dec 59, 23p. 7 refs. HSR-RM-59/26-sm; AD-234 464.
Order from LC mi$2.70, ph$4.80 PB 152 146

A case study of system research methodology.

Human Sciences Research, Inc., Arlington, Va.
MONTE CARLO METHODS AS TOOLS FOR SYSTEM RESEARCH. A SPECIAL REPORT IN A PROGRAM OF STUDY OF SYSTEM RESEARCH METHODS, by Alvin L. Schreiber. Rept. no. 7 on Contract Nonr-2525(00). Nov 59, 23p. 13 refs. HSR-RM-59/27-SM; AD-229 926.
Order from LC mi$2.70, ph$4.80 PB 150 839

A research program aimed at synthesis of system research methodology is continuing. Major features of one important class of analysis techniques, Monte Carlo methods are summarized. Ways in which these methods can be utilized in system research are presented. The mathematical bases and the computational procedures associated with Monte Carlo methods are not treated except as they are essential to exposition. The kinds of problems to which these methods can be applied, the conditions necessary for their application, and the kinds of solutions which they can provide are studied. (Author)

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Human Sciences Research, Inc., Arlington, Va.
RESEARCH METHODOLOGY REQUIREMENT-SETTING STUDIES, by Joseph E. McGrath and Peter G. Nordlie. Rept. no. 3 on Contract Nonr-2525(00). Nov 59, 43p. 49 refs. HSR-RM-59/23-SM; AD-229 924.
Order from LC mi$3.30, ph$7.80 PB 150 837

The methods which have been used in system research studies designed to establish various types of requirements for manned aspects of a complex man-machine system, principally weapon systems, were examined with reference to the review of approximately 50 pertinent research studies. Emphasis was placed on studies dealing with requirements for those aspects of the system relating to the human operator. Results of the review were organized by classifying studies into types, by dividing the total research task into phases, and by compiling and comparing the research methods used for studies of each type within each phase. Within these requirement-setting studies, areas where a relatively well articulated set of procedures exists, as well as areas where systematic, explicit methodology has not yet been fully developed, are indicated.

Human Sciences Research, Inc., Arlington, Va.
A SYSTEMATIC FRAMEWORK FOR COMPARISON OF SYSTEM RESEARCH METHODS, by Joseph E. McGrath, Peter G. Nordlie, and W. S. Vaughan, Jr. Rept. no. 1 on Contract Nonr-2525(00). Nov 59, 71p. 50 refs. HSR-TN-59/7-SM; AD-229 923.
Order from LC mi$4.50, ph$12.30 PB 150 836

Contents:
The problem and study approach
Historical development of system research
Discussion of system research orientations
Phase I: Study approach
A descriptive framework for comparison of system research methods
Structure of a system research problem
Descriptive classification of the system research process
Development of models in system research
Collection of information in system research
Synthesis of information in system research
Some concepts for a theory of method in system research
A model of research information
Reformulation of the descriptive framework
Evaluation and program plans

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS. Quarterly rept. for Apr-June 60. Aug 60, 48p. 40 refs. NAVWEPS rept. 6005; NOLC rept. 514.
Order from LC mi$3.30, ph$7.80 PB 152 035

Contents:
Ferroelectric phenomena
High temperature polymer program
Small antenna study
(See also PB 149 084)

Remington Rand Univac Div., Sperry Rand Corp., [Philadelphia, Pa.]
DIRECTIONS IN THE RETRIEVAL OF SCIENTIFIC INFORMATION, by C. K. Schultz and C. A. Shepherd. Rept. on Contract Nonr-2297(00). [1959] 32p. 15 refs. AD-228 389.
Order from LC mi$3.00, ph$6.30 PB 150 818

The role in scientific communication of secondary publications, such as abstracts and indexes, is traced from the early days of science to the present time in order to elucidate evolutionary trends. A brief evaluation is then given of the current communication network with respect to its evolutionary maturity for the field of science as a whole, and for individual scientific disciplines. (Author)

Institute for Applied Experimental Psychology, Tufts U., Medford Mass.
RESEARCH INVOLVING COMMUNICATION PROCESSES IN TASK ORIENTED GROUPS, by Thornton B. Roby, Bernard W. Harleston, and Lorraine D. Eyde. Technical rept. no. 2 on Contract Nonr-494(15). 15 Nov 59, 12p. 3 refs. AD-230 421.
Order from LC mi$2.40, ph$3.30 PB 150 495

Five broadly defined subfunctions of group performance were investigated. These were: vigilance; phasing; storage; patterning; and addressing. The general notion of vigilance refers to the probability of speed with which persons detect certain critical environmental signals. Phasing is concerned with temporal relationships among the component actions performed by various group members. Storage is defined as the extent to which information is retained for direct use in guiding group actions. Patterning consists of grouping various information items into an integrated picture. Addressing refers to the question of who needs certain categories of information. (See also PB 143 465)

Communication Theory

Ohio State U. Research Foundation, Columbus.
VOICE COMMUNICATION STUDIES, by John W. Black. Final rept. for 1 Oct 49-30 Sep 59, Contract N6onr-225(25), 29 Dec 59, 17p. 109 refs. Rept. 398-Final; AD-232 565.
Order from LC mi$2.40, ph$3.30 PB 152 172

A bibliography is presented of research in voice communications conducted by the Ohio State University foundation between October 1, 1949 and September 30, 1959. The bibliography may be viewed as related to these topics: (1) voice intelligibility; (2) dimensions of voice; (3) problems in listening; (4) hearing oneself, side tone; (5) the language of voice communication; (6) problems in hearing; and (7) the evaluation of equipment. In addition, a brief report is presented on the XI Congress of the International Association of Logopedics and Phoniatrics.

SOCIAL SCIENCES

Northwestern Technological Inst., Evanston, Ill.
INDUCTIVE INFERENCE AND BUSINESS BEHAVIOR, by R. W. Clower. ONR Research memo. no. 25 on Temporal Planning and Management Decision under Risk and Uncertainty, Contract Nonr-1228(10). Dec 59, 15p. 7 refs. AD-237 866.
Order from LC mi$2.40, ph$3.30 PB 148 197

An attempt was made to remove the shortcomings of traditional price theory as an instrument for describing observed market behavior. The approach taken was one which lies between the revolution of the foundations of traditional price theory and the evolution of its superstructures. To elaborate upon this theme, a simplified learning model of oligopoly was sketched which is broadly consistent with traditional doctrine yet sufficiently general to include both the established monopoly theory and the accepted theory of pure competition as special cases. The unifications of existing theories by recognizing that all of them are equally indeterminate in the absence of specific assumptions about the way in which market participants learn from experience was suggested.

Wisconsin U., Madison.
HIGH LATITUDE FRINGES OF SETTLEMENT, by Kirk H. Stone. Annual rept. on Contract Nonr-1202(05) 1 Dec 59, 18p. 6 refs. U. of Wis. no. 86:2439; AD-229 922.
Order from LC mi$2.40, ph$3.30 PB 152 110

The principal objective is to determine what settlement experience in Scandinavia (countries of older settlement) may be used in planning for present and additional settlement in northern North America (countries of newer settlement). These data may be obtained by the

location, classification, and determination of the characteristics of the fringe of settlement regions in Norway, Sweden, Finland, northern Canada, and Alaska. Especial attention is given to the measurement of the degree of permanence of settlement in these areas. (See also PB 143 859)

Documentation

Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio.
CHEMICAL NOTATION STUDY: DYSON-WISWESSER NOTATION SYSTEMS; ENCODING OPERATIONS. by Allan D. Pratt and James W. Perry. Phase rept. rev. on National Science Foundation Contract G 5754. 1 Aug 60, 53p. 2 refs.
Order from OTS $1.50 PB 171 123

A comparison was made of the structural-formula chemical-notation systems developed under the leadership of G. M. Dyson (Proposed international chemical notation: tentative version, Prepared by the Commission on codification, ciphering, and punched card techniques of the IUPAC, Longmans, Green and Co., London, 1958) and William J. Wiswesser (Line-formula chemical notation, Thomas Y. Crowell Co., N. Y., 1954). Three thousand structural formulas for encoding, provided by the Chemical Abstracts editorial office from Section 10 of that journal, were divided into 3 groups of 1000 each. Each group of 1000 compounds was encoded by each of the 2 systems by one each of 3 practicing chemists, 3 students working toward the doctorate in chemistry, and 3 undergraduate students majoring in chemistry. The Dyson ciphers were correct in 42.6% of the cases and the Wiswesser codes in 46.6%. The 4.0% difference is not meaningful. Undergraduate students achieved higher accuracies (58.3 and 56.4%) than either graduate students (41.5 and 50.2%) or the practicing chemists (28.0 and 33.0%) in both the Dyson and the Wiswesser systems. Participants thought that both systems contained ambiguities and unclear directions.

Remington Rand Univac Div., Sperry Rand Corp. [Philadelphia, Pa.]
A COMPUTER ANALYSIS OF THE MERCK SHARP AND DOHME INDEXING SYSTEM, by Claire K. Schultz and Clayton A. Shepherd. Rept. on Contract Nonr-2297(00). [1959] 37p. AD-229 380.
Order from LC mi$3.00, ph$6.30 PB 150 819

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS. Dec 60.
Order from OTS $1.25, $10.00/year PB 161 288

Contents:
Articles:
The Shell Model of the Nucleus and Proton Capture, by J. W. Butler
A Six-Port Trimode Turnstile Waveguide Junction, by R. S. Potter and C. E. Jedrey, Jr.
Scientific program:
Atmosphere and Astrophysics: Atmospheric scattering of aerosols in the visible and infrared. Flights of improved balloon-borne meteorological station (Transosonde) yield data on the vertical motions of air
Chemistry: Filterability of distillate fuels, 1: development of methods and effect of filter porosity. Kinetics of hydrogen evolution at zero hydrogen partial pressure. A dry chemical system for carbon dioxide removal from submarine atmospheres
Mathematics: Functional electromagnetic constitutive relations
Metallurgy and Ceramics: Creep rupture data for 0.250- and 0.357-inch diameter nickel specimens at 1500°F. Pile measurements of Hall coefficient and conductivity of silicon. Experimental assembly for studying effect of elevated temperature upon neutron-induced changes in steel. Kinetics of $CbZn_2$ formation on columbium in zinc vapor. Effect of oxygen solution on the oxidation of niobium. Effect of nonadherent corrosion products on localized attack of steel exposed to aqueous media at elevated temperature
Optics: An f/2.8 low-dispersion time-resolving grating spectrograph
Radio: Experimental shipboard multicouplers (2 Mc to 9 Mc) with system isolation in excess of 40 db for 5% frequency separation and transfer efficiency of 60% to 70%. Analysis of the relationship between collision-avoidance trajectory of an aircraft and its performance capability. Experimental tubes constructed and tested under high vacuum yield additional data on electrical breakdown in electron tubes. Electron gun for a lumped-parameter, backward-wave amplifier (225 Mc to 400 Mc)
Solid-State Physics: Solid-state analog of the Bragg-Gray cavity ionization chamber. Vibrational contribution to specific heat near phase change. Effect of pressure on the absorption spectra of phosphors: III, KCl:Tl
Sound: Effect of hydrostatic pressure on three types of resistors (the carbon composition type exhibits adaptability for pressure transducer applications)

ATOMIC ENERGY COMMISSION REPORTS

Reports may be purchased in accordance with instructions on the inside front cover of the U. S. GOVERNMENT RESEARCH REPORTS. As PB numbers are not indicated, order by series and number. These reports may also be consulted at any AEC Depository Library. A list of these libraries may be obtained from the U. S. Department of Commerce, Office of Technical Services, Washington 25, D. C.

Reproduction in whole or part of any report listed herein is encouraged by the U. S. Atomic Energy Commission, subject to the approval of authors or originating sites. General inquiries from the industrial press about AEC-developed information should be directed to the Industrial Information Branch, Atomic Energy Commission, Washington 25, D. C.

Biology and Medicine

Biological, chemical studies of marine plankton. Appendices to reference no. 60-6 conducted during the period May 15 through December 31, 1959. Woods Hole Oceanographic Institution, Mass. Feb 60. Contract AT(30-1)-1918. 159p. Order from LC. Mi $7.50, ph $24.30. AECU-4703

Biological and medical research division semiannual report from January through June, 1959, by W. H. Taliaferro and others. Argonne National Laboratory, Argonne, Ill. Aug 60. Contract W-31-109-eng-38. 105p. Order from OTS. $2.25. ANL-6200

A supplement to the LMFRE preliminary hazards evaluation. The Babcock & Wilcox Company, Lynchburg, Va. June 58. Contract AT(30-1)-1940. 27p. Order from OTS. $1.00. BAW-1017-1

Research in radiobiology. Annual report of work in progress on the chronic toxicity program, by T. F. Dougherty. University of Utah, College of Medicine, Salt Lake City, Utah. Mar 60. Contract AT(11-1)-119. 228p. Order from LC. Mi $9.90, ph $34.80. COO-220

Hanford biology research annual report for 1959, by H. A. Kornberg and others. Hanford Atomic Products Operation, Richland, Wash. Jan 60. Contract AT(45-1)-1350. 205p. Order from OTS. $3.00. HW-65500

An analogue computor for the generalized three-compartment model of transport in biological systems, by E. C. Gregg. Western Reserve University, Atomic Energy Medical Research project, Cleveland, Ohio. Dec 59. Contract W-31-109-eng-78. 25p. Order from LC. Mi $2.70, ph $4.80. NYO-2096

A quantiative study of the effects of radiation on the blood capillaries of normal animals. Final scientific report. University of Miami, Coral Gables, Fla. [nd.] 8p. Order from LC. Mi $1.80, ph $1.80. ORO-230

Final and comprehensive report on work accomplished, by N. T. Werthessen. Southwest Foundation for Research and Education, San Antonio, Tex. Dec 59. Contract AT(40-1)-1776. 16p. Order from LC. Mi $2.40, ph $3.30. ORO-233

The effects of radiation on root growth of higher plants. Final report, by R. T. Brumfield. Longwood Coll., Farmville, Va. Jan 60. Contract AT(40-1)-1676. 24p. Order from LC. Mi $2.70, ph $4.80. ORO-237

Electrocardiograph measurements at operation teapot, by H. H. Sander and O. J. Birdsong. Sandia Corporation, Albuquerque, N. Mex. Dec 55. 22p. Order from LC. Mi $2.70, ph $4.80. SCTM-261-55-51

Marine Sciences Research, by C. L. Dunham and others. University of Connecticut, Marine Research Laboratory, Storrs, Conn. Jan 60. 40p. Order from OTS. 50 cents. TID-4040

Toxicity and hazards of beryllium and rocket propellants. A literature search, by W. E. Bost. Office of Technical Information Extension, Oak Ridge, Tenn. Oct 60. 20p. Order from OTS. 50 cents. TID-3531 (1st Rev.)

Effects of radiation on pure proteins and nucleic acids, by Virgil L. Koenig. Northwestern University., Chicago. Medical School. [Mar 60]. Project No. 8. Contract AT(11-1)-89. 8p. Order from LC. Mi. $1.80 Ph. $1.80. TID-5692

Studies on chemical protection against radiation-induced intestinal injury. Period covered: June 1, 1959-March 1, 1960, by E. E. Schwartz and B. Shapiro. Mar 60. Contract AT(30-1)-2406. 7p. Order from LC. Mi $1.80, ph $1.80. TID-5827

Studies of protein synthesis in the gastrointestinal tract of normal and irradiated mice. Final report. Cornell University, Medical College, Ithaca, N. Y. [1960]. Contract AT(30-1)-2179. 16p. Order from LC. Mi $2.40, ph $3.30. TID-5882

The use of calcium-47 in diagnostic studies of patients with bone lesions, by K. R. Corey and others. Sloan-Kettering Inst. for Cancer Research, New York, N. Y. [1960]. Contract AT(30-1)-910. 60p. Order from LC. Mi $3.60, ph $9.30. TID-5954

Progress report for the period October 1, 1959 to September 30, 1960, Marquette University, Milwaukee, Wis. 1960. Contract AT(11-1)-820. 12p. Order from LC. Mi $2.40, ph $3.30. TID-6043

The biologic effects of radiation on thyroid tissue. Annual progress report for May 16, 1959 to May 15, 1960 and renewal application, by O. Cope. General Hospital, Boston, Mass. June 60. 11p. Order from LC. Mi $2.40, ph $3.30. TID-6063

Mechanisms of radiation-chemical reaction in biochemical systems, by W. M. Garrison. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. June 60. Contract W-7405-eng-48. 10p. Order from OTS. 50 cents. UCRL-9218

Progress report for period ending July 31, 1960, by R. S. Stone and G. D. Adams. University of California School of Medicine, Department of Radiology, San Francisco, Calif. Sep 60. Contract AT-11-1-GEN-10, Project No. 2. 55p. Order from OTS. $2.00. UCSF-20

Experimental radiation therapy of tumors using I^{131} carrying antibodies to fibrin, by W. F. Bale and others. University of Rochester, Atomic Energy Project, Rochester, N. Y. Mar 60. Contract W-7401-eng-49. 25p. Order from LC. Mi $2.70, ph $4.80. UR-567

Distribution of injected I^{131} labeled antibody to dog fibrin in tumorbearing dogs, by I. L. Spar, and others. University of Rochester, Atomic Energy Project, Rochester, N. Y. Mar 60. Contract W-7401-eng-49. 13p. Order from LC. Mi $2.40, ph $3.30. UR-569

Rapid determination of citric acid in biological fluids, by K. Lane and P. S. Chen, Jr. The University of Rochester, Atomic Energy Project, Rochester, N. Y. Sep 60. Contract W-7401-eng 49. 7p. Order from OTS. 50 cents. UR-579

Chemistry—General

The electrochemical theory of smelting and related reactions. Technical report no. 36, by X. de Hemptinne and others. University of Utah. Institute for the Study of Rate Processes, Salt Lake City, Utah. Nov 59. Contract AT(11-1)-82. 43p. Order from LC. Mi $3.30, ph $7.80. AECU-4504

Anodic precipitation of tracer manganese as dioxide, E. A. Heintz and L. B. Rogers. Massachusetts Institute of Technology, Cambridge, Mass., and Massachusetts Institute of Technology, Laboratory, for Nuclear Science, Cambridge, Mass. [1959]. Contract AT(30-1)-905) 25p. Order from LC. Mi $2.70, ph $4.80. AECU-4560

Final progress report--August 15, 1956 through termination on August 30, 1958, by L. E. Zeeb, Jr. and others. National Spectrographic Laboratories, Inc., Cleveland, Ohio. Oct 58. Decl. with deletions February 17, 1960. Contracts AT(11-1)-171 and AF33(600)-38062. 77p. Order from LC. Mi $4.50, ph $12.30. APEX-431(Del.)

Diffusion of Xenon through aluminum and stainless steel, by A. W. Castleman, F. E. Hoffmann, and A. M. Eshaya. Brookhaven National Laboratory, Associated Universities, Inc., Upton, N.Y. July 60. 9p. Order from OTS. 50 cents. BNL-624 (T-190)

Process engineering report on revised process design transmittal, green salt plant, job no. 3004 of the feed materials production center, Fernald, Ohio, by G. V. Holby and F. James. Catalytic Construction Co., Philadelphia, Pa. June 52. Decl. October 7, 1959. Contract AT(30-1)-1060. 22p. Order from LC. Mi $2.70, ph $4.80. CCCO-557

Chemistry—Radiation and Radiochemistry

The Radiochemistry of Indium, by D. N. Sunderman and C. W. Townley. Battelle Memorial Inst., Columbus, Ohio. May 60. 46p. Order from OTS. 50 cents. NAS-NS 3014

Halogen collector test program, Hanford Atomic Products Operation, Richland, Wash., Div. of General Electric. March 60. Contract AT(45-1)-1350. 76p. Order from OTS. $2.00. HW-65587

The Radiochemistry of Astatine, by Evan H. Appelman, Argonne National Lab., Lemont, Ill. March 60. 29p. Order from OTS. .50 cents. NAS-NS 3012

Chemistry—Separation Processes for Plutonium and Uranium

Design and Scaleup of Mixer-Settlers for the Dapex solvent extraction process, by A. D. Ryon, F. L. Daley and R. S. Lowrie. Oak Ridge National Lab., Oak Ridge, Tennessee. [nd] Contract W-7405-eng-26. 74p. Order from OTS. $1.75. ORNL-2951

Bibliography on nuclear reactor fuel reprocessing and waste disposal, Vol. 2, by T. F. Conolly, Oak Ridge National Lab., Oak Ridge, Tennessee. [nd], Contract W-7405-eng-26. 152p. Order from OTS. $2.75. ORNL-2971

Chemical technology division annual progress report for period ending August 31, 1960, by F. L. Culler and others. Oak Ridge National Lab., Oak Ridge, Tenn. [nd], Contract W-7405-eng-26. 228p. Order from OTS. $3.50. ORNL-2993

Controlled Thermonuclear Processes

Electron gun measurements in a stellarator with Helical stabilizing windings, by M. S. Jones, Jr., G. Hess and L. G. Smith, Office of Technical Information Extension, Oak Ridge, Tenn. July 59. Contract AT(30-1)-1238. 23p. Order from OTS. 75 cents. MATT-14

End-losses from mirror machines, by J. E. Roberts, and M. L. Carr. University of California, Lawrence Radiation Lab., Livermore, Calif. Apr 60. Contract W-7405-eng-48. 80p. Order from OTS. $2.00. UCRL 5651-T

A simple analysis of the tubular pinch discharge, by Wulf B. Kunkel. University of California, Lawrence Radiation Lab., Berkeley, Calif. Jul 60. Contract W-7405-eng-48. 15p. Order from OTS. 50 cents. UCRL 9311

Criticality Studies

Hazards summary report for the hanford plutonium critical mass laboratory, by W. A. Reardon and others. Hanford Atomic Products Operation, Richland, Washington. Aug 60. Contract AT(45-1)-1350. 124p. Order from OTS. $2.50. HW-66266

Multi-region reactor lattice studies, by Ira H. Coen, Westinghouse Electric Corp., Atomic Power Dept. Pittsburgh, Penna. Jul 60. Contract AT(30-1)-2176. 31p. Order from OTS. 75 cents. WCAP-1419

Engineering and Equipment

Leakage of water from gasketed joints proposed for the HWCTR, by Frederick C. Apple, E. I. du Pont de Nemours & Co. Savannah River Lab., Jul 60. Contract AT(07-2)-1. 11p. Order from OTS. 50 cents. DP-487

Contact resistance and the effects of materials and process variables on contact resistance and contact reliability in switching devices, by L. M. Berry and others. Sandia Corp., Albuquerque, N. Mex. Aug 60. 50p. Order from OTS. $1.50. SCTM 73A-60(16)

Steam jet pump analysis and experiments, by R. P. Rose, Bettis Atomic Power Lab., Pittsburgh, Pa. June 60. Contract AT-11-1-GEN-14. 121p. Order from OTS. $2.75. WAPD-TM-227

Geology and Mineralogy

Reconnaissance for uranium in the Salamanca area, Province of Coquimbo, Chile, by P. H. Knowles, and others. U. S. Atomic Energy Commission, Geologicas De Chile. July 58. 14p. Order from OTS. 50 cents. RME-4526

Fossil fuels in the future, by M. F. Searl, Office of Operations Analysis and Forecasting, United States Atomic Energy Commission. Oct. 60. 63p. Order from OTS. 75 cents. TID-8209

Health and Safety

Fallout program, Quarterly summary report, by E. P. Hardy, Jr. and others. United States Atomic Energy Commission, New York

operations office. Oct 60. 210p. Order from OTS. $3.00. HASL-95

Radioactive fallout from nuclear detonations of February and April 1960, by A. W. Klement, Jr., Fallout Studies Branch, U. S. Atomic Energy Commission, Washington 25, D. C. Jun 60. 13p. Order from OTS. 50 cents. TID-6235

Instrumentation of structures for air-blast and ground shock effects, by J. J. Meszaros and others. Ballistic Research Labs., Aberdeen Proving Ground, Md. Jan. 60. 75p. Order from OTS. $1.75. WT-1452

Instruments

The linear scanner in clinical studies, by F. Pircher, Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tenn. Aug 60. 37p. Order from OTS. $1.00. ORINS-36

A small wrist dosimeter for beta and gamma radiation, by H. H. Hubbell, Jr. and others. Oak Ridge National Lab., Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 116p. Order from OTS. $2.50. ORNL-2730

Inline instrumentation: Gamma monitor, Uranium colorimeter, by J. W. Landry. Oak Ridge National Lab., Oak Ridge, Tenn. Sep 60. Contract W-7405-eng-26. 25p. Order from OTS. 50 cents. ORNL-2978

Metallurgy and Ceramics

Thermal diffusion of hydrogen in nonstoichiometric zirconium-dihydride, by A. W. Sommer. Atomics International, Div. of North American Aviation, Inc., Canoga Park, Calif. Oct 60. Contract AT(11-1)-GEN-8. 27p. Order from OTS. 75cents NAA-SR-5066

Carburization of austenitic stainless steel in liquid sodium, by W. J. Anderson and G. V. Sneesby. Atomics International, Div., of North American Aviation, Inc., Canoga Park, Calif. Sept 60. Contract AT(11-1)-GEN-8. 27p. Order from OTS. 75 cents. NAA-SR-5282

Technical progress report to the AEC reactor division for the period ending June 30, 1959. Nuclear Metals, Inc., Concord, Mass. Jul 60. Contract AT(30-1)-1565. 156p. Order from OTS. $2.75. NMI-1216

Nuclear Explosions—Peaceful Applications

Ground water in the oak spring formation and hydrologic effects of underground nuclear explosions at the nevada test site, by A. Clebsch, Jr. U. S. Geological Survey for the U. S. Atomic Energy Commission. Apr 60. 29p. Order from OTS. 75 cents. TEI-759

Pressure observations in the crater vicinity during the explosion of small charges in dry sand, by R. P. Reed and W. E. Taylor. Sandia Corp., Albuquerque, N. Mex. May 60. 33p. Order from OTS. $1.00. SC-4448(RR)

Plowshare series: Report No. 2, proceedings of the second plowshare symposium part I. Univ. of Calif. Lawrence Radiation Lab., Livermore, Calif. May 59. Contract W-7405-eng-48. 164p. Order from OTS. $3.00. UCRL-5675.

Particle Accelerators and High-Voltage Machines

The production by surface currents of magnetic fields suitable for spiral ridge accelerators, by E. S. Akeley. Midwestern Universities Research Association. [nd] 35p. Order from OTS. $1.00. MURA-569

Acceleration across transition energy, by G. Bronca. Midwestern Universities Research Association, Madison, Wisc. May 60. Contract AT(11-1)-384. 15p. Order from OTS. 50 cents. MURA-575

Drift tube alignment for the AGS linac, by A. Kevey. Brookhaven National Lab., Upton, N. Y. Mar 60. 9p. Order from LC. Mi. $1.80 Ph. $1.80. BNL-4689

Physics and Mathematics

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Milne problem with capture, by S. N. Purohit. Oak Ridge National Lab. Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 28p. Order from OTS. 75 cents. ORNL-3005

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U. S. DEPARTMENT OF COMMERCE FIELD OFFICES

SERVE THE BUSINESS COMMUNITY

The Department of Commerce maintains Field Offices to enable the business community to avail itself locally of Government facilities designed to promote commerce. Working closely with various units in the Department and, when necessary, with other Government agencies, the Field Offices provide business services to manufacturers, wholesalers, retailers, trade publications, trade associations, advertising agencies, research groups, financial institutions, and exporters and importers.

Experienced personnel will gladly assist in the solution of specific problems, explain the scope and meaning of regulations administered by the Department, and provide practical assistance in the broad field of domestic and foreign commerce. Field offices act as official sales agents of the Superintendent of Documents, and maintain an extensive business reference library containing periodicals, directories, publications and reports from official as well as private sources.

Among the many services which businessmen have found of value are:

GENERAL

- Management and business aids
- Establishing a new business

BASIC ECONOMIC DATA

- Census data, with national and often State and regional breakdowns, on manufacturing, wholesaling, retailing, service industries, employment and unemployment, population, housing, agriculture
- Basic records of national income and product, regional trends, balance of payments, foreign aid

MARKETING AND DISTRIBUTION

- Development and maintenance of markets
- Distribution channels, facilities and services
- Marketing and distribution statistics

PRODUCTION

- Modernization of plant processes and other technological aids
- Development of new products
- Government-owned patents for free license
- Commodity standards

FOREIGN TRADE AND INVESTMENT

- Tariff and exchange regulations
- Import and export quotas, licensing regulations
- Statistics on imports and exports
- Investment and trade opportunities abroad
- Economic conditions in foreign countries

COOPERATIVE OFFICES

To make the services of the Department of Commerce more widely available, agreements have been entered into with more than 750 Chambers of Commerce, Manufacturers Associations, and similar business groups under which these organizations have become official Cooperative Offices of the Department. If specific information is not on hand in the Cooperative Office, your problem will be referred to the nearest Departmental field office.

Department Field Offices

ALBUQUERQUE, N. MEX., Post Office Bldg.
ATLANTA 3, GA., 66 Luckie Street NW.
BOSTON 9, MASS., Post Office and Courthouse
BUFFALO 3, N. Y., 117 Ellicott Street
CHARLESTON 4, S. C., Sergeant Jasper Bldg., West End Broad Street
CHEYENNE, WYO., Federal Office Bldg.
CHICAGO 6, ILL., 226 West Jackson Blvd.
CINCINNATI 2, OHIO, Post Office and Courthouse
CLEVELAND 14, OHIO, 1100 Chester Avenue
DALLAS, TEX., 500 South Ervay Street
DENVER 2, COLO., New Custom House
DETROIT 26, MICH., Federal Bldg.
GREENSBORO, N. C., Post Office Bldg.
HOUSTON 2, TEX., 430 Lamar Avenue
JACKSONVILLE 1, FLA., Federal Bldg.
KANSAS CITY 6, MO., Federal Office Bldg.
LOS ANGELES 15, CALIF., 1031 South Broadway
MEMPHIS 3, TENN., 22 North Front Street
MIAMI 32, FLA., 300 NE. First Avenue
MINNEAPOLIS 1, MINN., Metropolitan Bldg.
NEW ORLEANS 12, LA., 333 St. Charles Avenue
NEW YORK 17, N. Y., 110 E. 45th Street
PHILADELPHIA 7, PA., 1015 Chestnut Street
PHOENIX, ARIZ., 137 N. Second Avenue
PITTSBURGH 22, PA., 107 Sixth Street
PORTLAND 4, OREG., Old U. S. Courthouse
RENO, NEV., 1479 Wells Avenue
RICHMOND 19, VA., 1103 East Main Street
ST. LOUIS 1, MO., New Federal Bldg.
SALT LAKE CITY 1, UTAH, 222 S. W. Temple Street
SAN FRANCISCO 11, CALIF., 555 Battery Street
SAVANNAH, GA., U. S. Courthouse and Post Office Bldg.
SEATTLE 4, WASH., Federal Office Bldg.

For local telephone listing, consult section devoted to U. S. Government

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